

M 1304-1935

FROM

THE FECHHEIMER BROS. CO

UNIFORMS

HEADWEAR AND EQUIPMENTS

CINCINNATI, O.

PRIMARY FLYING SCHOOL

GROUND SCHOOL NOTES

DO NOT WRITE IN THIS SPACE

50% with Insh.

DATE ORANGEBURG, S. C.		WING CORPS AREA OR DEPT. A. C. T. DET.		AIR CORPS BRANCH PT-17		R-670-5								
STATION		GROUP NO. AND TYPE		AIRPLANE MODEL		ENGINE MODEL								
CREW CHIEF OR AERIAL ENGINEER		ORG. NO. AND TYPE		AIRPLANE SERIAL NO.		ENGINE SERIAL NO.								
PERSONNEL		— PRINT PLAINLY — NAME — RANK — ORGANIZATION		USE AS DIRECTED LOCALLY	ALWAYS ENTER DUTY SYMBOLS. WHEN APPLICABLE, ENTER N - NIGHT OR I - INSTRUMENT. ENTER TIME FLOWN THEREUNDER				FLIGHT DATA					
CLASS	SERIAL NO.				DUTY	N OR I	DUTY	N OR I	DUTY	N OR I	DUTY	N OR I	TERMINALS AND MISSION	TIME
1	2	3		4	5	6	7	8	9	10				
45	CAA 12345	Brown, A.B. (Civ.)			P								FROM: LOCAL	7:00
32	0-383418	WITTE, R.B. Jr. (2nd Lt)			P								TO: 8:00	8:00
													MISSION: S-5	1:00
													NO. OF LANDINGS 3	1:00
32	0-383418	WITTE, R.B. Jr. (2nd Lt)			P								FROM: LOCAL	8:30
													TO: 9:30	9:30
													MISSION: S-5	1:00
													NO. OF LANDINGS 3	1:00
45	CAA 35566	FOSTER, H.L. (Civ.)			P								FROM: LOCAL	13:30
32	0-383418	WITTE, R.B. (2nd Lt)			P								TO: 14:30	14:30
		GROUND LOOPED IN LANDING Russell B. Witte											MISSION: S-5	1:00
													NO. OF LANDINGS 1	1:00
													FROM:	:
													TO:	:
		FORCED LANDING OF											MISSION:	:
		LOST DUE TO INSUFFICIENT GAS Russell B. Witte											NO. OF LANDINGS	:
													FROM:	:
													TO:	:
													MISSION:	:
													NO. OF LANDINGS	:

WAR DEPARTMENT AIR CORPS - FORM NO. 1 TENTATIVE - SEPT. 1940	FLIGHT REPORT - OPERATIONS	CHECKED: LEGIBLE AND CORRECT	☐ OPER. CLERK	TRANSCRIBED: TOTAL FLIGHT TIME ENTERED ON FORM 1A	☐ CREW CHIEF	TOTAL FLIGHT TIME
--	----------------------------	------------------------------------	---	--	--	-------------------------

DO NOT WRITE IN THIS SPACE

DO NOT WRITE IN THIS SPACE

DO NOT WRITE IN THIS SPACE

DATE		WING CORPS AREA OR DEPT.		BRANCH		ENGINE MODEL								
STATION		GROUP NO. AND TYPE		AIRPLANE MODEL		(1) ENGINE SERIAL NO. (2) ENGINE SERIAL NO.								
CREW CHIEF OR AERIAL ENGINEER		ORG. NO. AND TYPE		AIRPLANE SERIAL NO.		(3) ENGINE SERIAL NO. (4) ENGINE SERIAL NO.								
PERSONNEL		— PRINT PLAINLY — NAME — RANK — ORGANIZATION		USE AS DIRECTED LOCALLY	ALWAYS ENTER DUTY SYMBOLS. WHEN APPLICABLE, ENTER N-NIGHT OR I-INSTRUMENT. ENTER TIME FLOWN THEREUNDER				FLIGHT DATA					
CLASS	SERIAL NO.				DUTY	N OR I	DUTY	N OR I	DUTY	N OR I	DUTY	N OR I	TERMINALS AND MISSION	TIME
1	2	3		4	5	6	7	8	9	10				
45	CAA 12345	BROWN, A.B. (Civ.)			P	1:00	:	:	:	:	:	:	FROM: LOCAL	7:00
32	0-383418	WITTE, R.B. JR. (2nd Lt)			P	1:00	:	:	:	:	:	:	TO:	8:00
													MISSION:	NO. OF LANDINGS
													5-5	3 1:00
32	0-383418	WITTE, R.B. JR. (2nd Lt)			P	1:00	:	:	:	:	:	:	FROM: LOCAL	8:30
													TO:	9:30
													MISSION:	NO. OF LANDINGS
													5-5	3 1:00
45	CAA 35566	FOSTER, H.L. (Civ.)			P	1:00	:	:	:	:	:	:	FROM: LOCAL	13:30
32	0-383418	WITTE, R.B. (2nd Lt)			P	1:00	:	:	:	:	:	:	TO:	14:30
		GROUND LOOPED IN LANDING Russell B. Witte											MISSION:	NO. OF LANDINGS
													5-5	1 1:00
													FROM:	:
													TO:	:
		FORCED LANDING OF LOST DUE TO INSUFFICIENT GAS Russell B. Witte											MISSION:	NO. OF LANDINGS
													:	:
													FROM:	:
													TO:	:
													MISSION:	NO. OF LANDINGS
													:	:

WAR DEPARTMENT
AIR CORPS - FORM NO. 1
TENTATIVE - SEPT. 1940

FLIGHT REPORT - OPERATIONS

CHECKED:
LEGIBLE AND
CORRECT

☐ OPER.
CLERK

TRANSCRIBED:
TOTAL FLIGHT
TIME ENTERED
ON FORM 1A

☐ CREW
CHIEF

TOTAL
FLIGHT
TIME

INSPECTION STATUS

 AIRPLANE AND ENGINE TIME RECORD
(ENTER IN HOURS AND MINUTES)

SERVICING AT STATION OF TAKE-OFF

(CHECK IMMEDIATELY BEFORE TAKE-OFF)

	DATE OF OR HOURS DUE	INSPECTED TODAY		ENGINE HOURS TO DATE HOURS TODAY TOTAL OIL CHANGE DUE CUNO. CLEANING DUE	NO. 1	NO. 2	NO. 3	NO. 4	SERVICE	FUEL (GALLONS)		OIL (QUARTS)								RADIATOR CHECKED
		BY	STATION							SERV-ICED	IN TANKS	NO. 1		NO. 2		NO. 3		NO. 4		
PREFLIGHT												SERV-ICED	IN TANKS	SERV-ICED	IN TANKS	SERV-ICED	IN TANKS	SERV-ICED	IN TANKS	
DAILY																				
25 HOURS																				
50 HOURS																				
100 HOURS																				
				AIRPLANE	HOURS TO DATE															
					HOURS TODAY															
					TOTAL															

STATUS TODAY

1. 2.

 EXPLANATION: Rear tank out

EXCEPTIONAL RELEASE

WHEN THE "STATUS TODAY" IS INDICATED BY A RED SYMBOL AND AN "EXCEPTIONAL RELEASE" HAS NOT BEEN GRANTED BY AN AUTHORIZED ENGINEERING OFFICER, THE PILOT OF THE AIRPLANE WILL SIGN THIS RELEASE BEFORE FLIGHT.

RELEASED FOR FLIGHT

1. 2. 3. 4.

INSPECTION OF AUXILIARY EQUIPMENT

EQUIPMENT	SYMBOL	INSPECTED BY	STATION
BOMBARDMENT			
GUNNERY			
NAVIGATION			
RADIO			
OXYGEN			
PHOTOGRAPHIC			
CHEMICAL			

INSTRUCTIONS FOR PILOTS AND MECHANICS

PILOTS: EACH PILOT WILL PRINT NAME AND RANK BELOW, AND INDICATE "OK" OR, IF ANY DEFECT OR MALFUNCTIONING OCCURRED, EXPLAIN THE TROUBLE.

MECHANICS: TRANSPOSE "TOTAL FLIGHT TIME" FROM FORM 1 TO ENTRIES "HOURS TODAY" UNDER "AIRPLANE AND ENGINE TIME RECORD" ABOVE. PRECEDE EACH REMARK WITH THE NAME OF THE STATION. EXPLAIN ANY RED SYMBOL ENTERED UNDER "INSPECTION OF AUXILIARY EQUIPMENT". ENTER ANY MAINTENANCE WORK DONE WHILE AIRPLANE IS ON THE FLYING LINE OR AWAY FROM ITS HOME STATION. SIGN EACH REMARK MADE.

#1 WITTE, R.B. JR. 2nd Lt OK
 #2 WITTE, R.B. JR. 2nd Lt OK
 #3 WITTE, R.B. JR. 2nd Lt ND

Inst for pilots and mechanics

#1 Brown

Dispatchers Board

Ship	Inst	7 ⁰⁰ to 8 ⁰⁰	8 ⁰⁰ to 9 ⁰⁰
14	Jones	Johns	Witte
15			

check in and out thru dispatcher

Getting in Ship & Starting

1. Report to inst. and check out with dispatcher
1. Get in on left hand side
2. Adjust seat to proper elevation.
3. Fasten safety belt.
4. Start filling out Form 1 + 1a
5. Unlock Controls
6. Hand crank to mechanic
7. Repeat after him
 1. Gas on
 2. Switch off
 3. Throttle closed
8. Repeat "Contact" after mechanic and immediately turn on switch and crack throttle to ± 500 RPM
9. Replace crank.
10. While on apron taxi slow enough so men guiding wings go to faster than a walk.
11. When mechanics leave ship immediately start firing the ship or chasing your point.

YOU TOO, CAN FLY!! yea Man!!

Good flying technique is based upon the proficient performance of but four basic fundamentals of flight. The early hours of flight instruction are devoted to their successful accomplishment. They are 1. straight and level flight, 2. the climb, 3. the glide and 4. the turn. All of these are important because all flight maneuvers consist of combinations of one or more of these basic fundamentals. Unless a student can properly perform straight and level flight, climbs, glides and turns it is obvious that he will be unable to progress to more intricate maneuvers.

OPERATION OF THE CONTROLS.

The function of the plane's control system is to direct the course of the ship and to permit it to change direction about any of its three axes.

Pressure on the rudder pedal causes the ship to rotate about its vertical axis and moves the nose of the plane toward the side on which pressure is applied. Sideward movement of the stick operates the ailerons and rotates the plane about its longitudinal axis, causing the wing toward which the stick is moved to go down and the opposite wing up.

Forward movement of the stick moves the elevators down and rotates the plane about its lateral axis, causing the nose to move away from the pilot. Backward movement of the stick moves the elevators up and brings the nose toward the pilot.

Coordinated movements of these three controls can put the airplane in any desired attitude. Learning to fly is merely the development of skill in smoothly blending control pressures to direct the course of the plane.

STRAIGHT AND LEVEL FLIGHT

The attitude of the ship is checked longitudinally by sighting the horizon over the nose, laterally by sighting under the wing tips and observing that the same amount of sky is visible between the left wing and the horizon as is visible between the right wing and the horizon.

Only very slight pressures are required to alter the plane's flight paths, never abrupt movements of the controls.

TECHNIQUE OF THE TURN.

Unlike an automobile where the steering wheel is kept turned throughout the turn, in an airplane the controls are RETURNED TO NEUTRAL POSITION once the turn has been established.

For a left turn, for example, a slight pressure is applied to left rudder to start the nose yawing and, AT THE SAME TIME, the stick is pressed to the left to bank the plane. When the desired degree of bank has been reached, rudder pressure is relaxed and the stick returned to neutral position. The plane will continue to turn.

Recovery is effected by pressing right rudder and bringing the stick to the right. Controls are again returned to neutral as the ship resumes its level flight attitude.

CLIMBS AND GLIDES (CON'T'D)

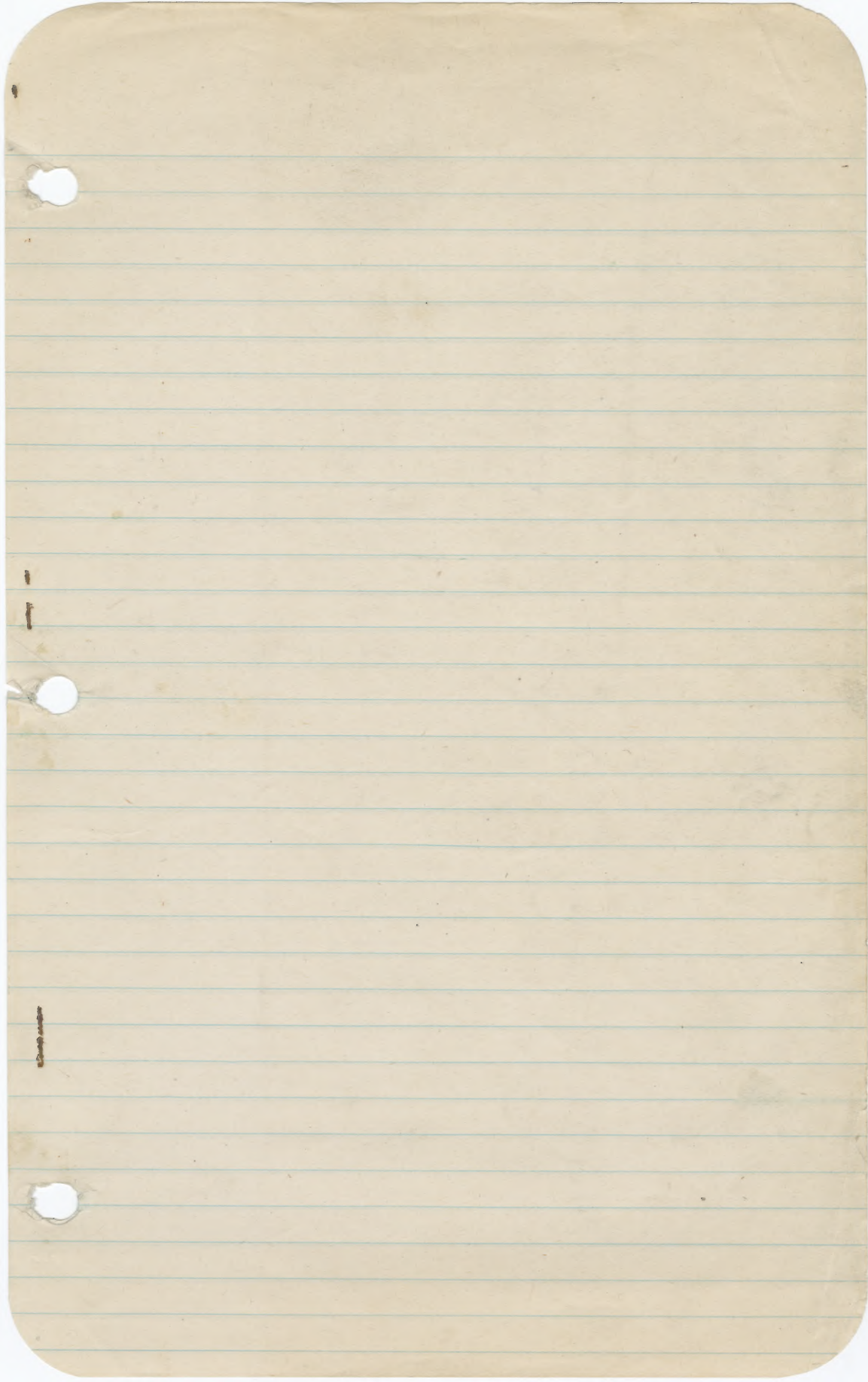
CLIMBS AND GLIDES (CON'T'D)

An airplane is made to climb by the exertion of a slight backward pressure on the stick. This causes an upward movement of the elevators, which, of course forces the tail down and brings the nose toward the pilot to put the plane in a climbing attitude.

A glide is achieved by throttling the engine back and letting the nose drop slightly below the horizon by relaxing back pressure on the stick. Like a car rolling down a slope, the plane then maintains its flying speed by "coasting" down an imaginary hill of air.

MAINTAIN FLYING SPEED.

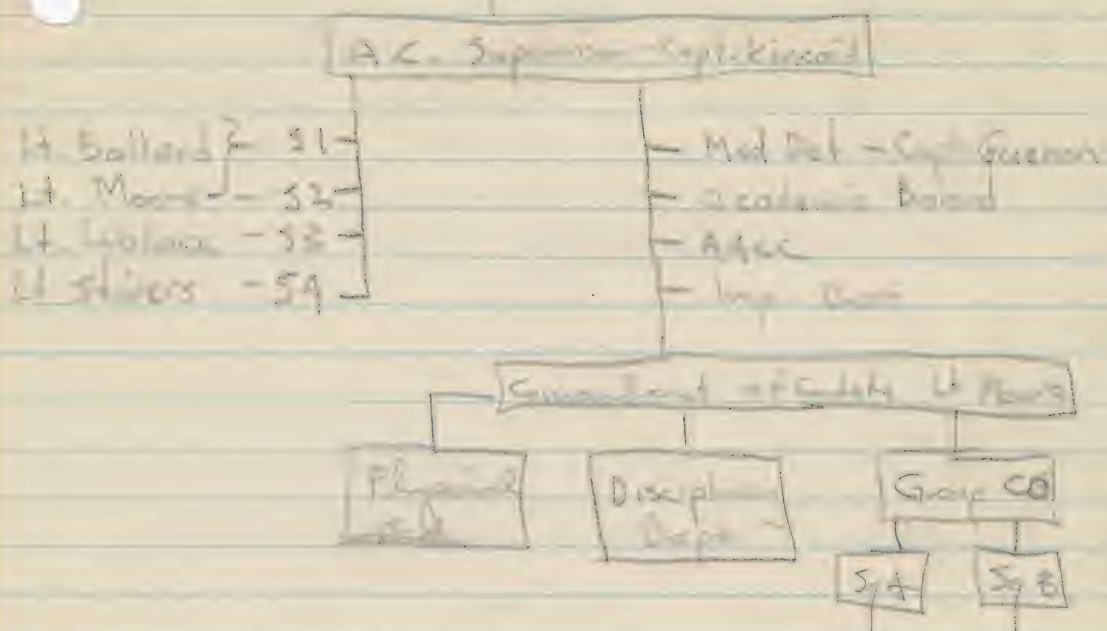
Too much stress cannot be placed on the importance of maintaining speed when flying, for the greatest single force in keeping an airplane in the air is speed. In climbs and level flight the ship's speed is derived from the pull of the engine. In glides or dives it is the result of the pull of gravity.





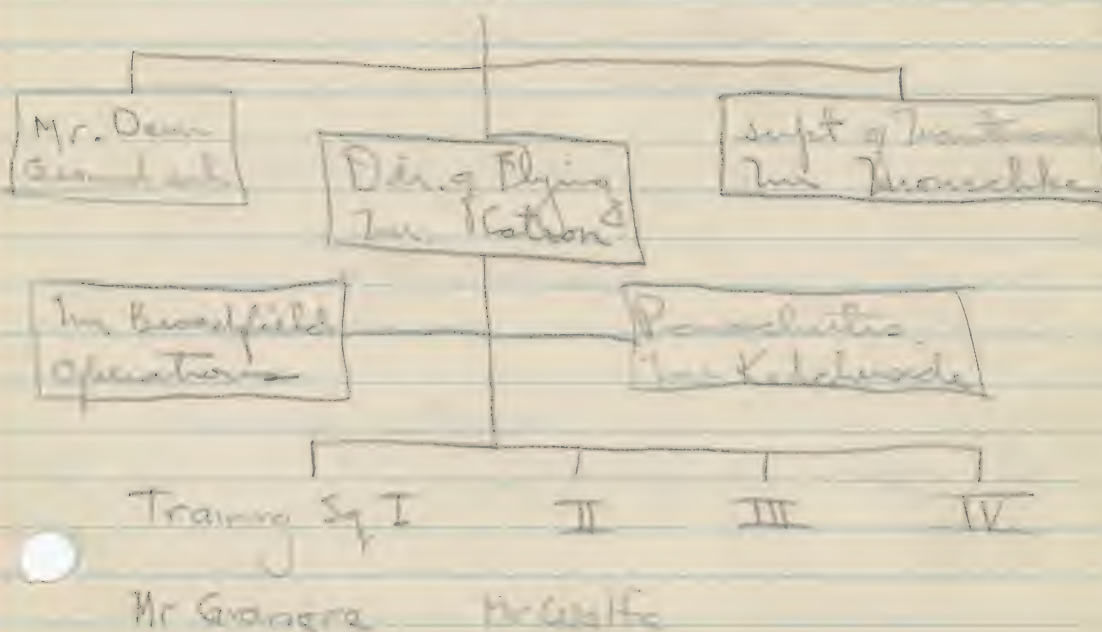
SCHOOL ORGANIZATION

No. 35427C



School Org.

Pres



Course Sheet

Subjects

- 31 hr 1. Engines - Jones & Langenbach
- 32 2. Engines - Thompson & Taylor of Flight
- 22 3. Navigation - Condit
- 30 4. Navigation - Harrison
- 32 5. Mathematics - [illegible]
- 140 hr

Time Engines - Flight Inst.
Engines -

Assignment in TM 1-405 For 1 hour

Form 2a & 1A's - record of flight

Column I - [illegible] No 37
Student Officer -
Instructor - 45

Mission 3-5 Student [illegible]

Take off time - of actual take off
Landing time - time of return to flying base

Must have indelible pencil
to sign certificate

Form 1A: Logbook of record of time

Indelible pencil
[illegible] must be used for flight log entries

PREPARATORY STEPS BEFORE MAKING A TAKEOFF,
AND TAKING OFF AND FLYING OUT OF PATTERN

1. Put on parachute and climb into plane on left side.
2. Clamp and adjust safety belt, ~~and~~ adjust seat to proper elevation, and adjust rudder pedals.
3. Unlock controls, ~~and~~ start filling out Form 1 and check Form 1A for clearance on any red diagonals, then replace book and close cover.
4. Adjust altimeter to read '0'.
5. Hand crank to mechanic then check each item as you repeat after him (a) "Gas On", (b) "Switch Off", and (c) "Throttle closed".
6. Repeat "Contact" after mechanic and immediately turn switch to 'Both' and crack throttle to ± 500 RPM, holding stick back and brakes on.
7. Replace crank and snap handle into clamp.
8. Motion mechanics to pull out caulkers then release brakes and using rudder and brakes slowly guide plane off the apron.
9. When mechanics leave ~~the~~ the plane immediately start 'S'ing it with the Wind T out to the take off line where you stop it at 45° to the take off direction.
10. Clamp brakes on hard and advance the throttle until the tachometer shows about 1200 RPM, then turn switch to Left Mag. & check drop in RPM, turn switch back to 'Both' to regain original RPM. then turn it to Right Mag. and check drop in RPM.
11. Close throttle and look up and back along pattern to make sure no planes are coming in for a landing, ~~and~~ gun throttle enough to swing plane around to take off ~~position~~ position then momentarily close throttle while

- you pull down your glasses and check the time.
12. Give the plane full throttle and as it gains speed ease the stick forward to bring the tail up, keeping the plane on a straight course by using the rudder.
 13. As the plane gains more speed slowly ease back on the stick until the plane leaves the ground, ~~level~~ level up for a short time to gain speed, then climb straight away to 300'.
 14. At 300' level off pull throttle back to $\frac{1}{2}$ throttle make a 90° turn in the 'T' direction, having first cleared yourself by looking back in the direction of the turn, then climb straight away to 500'.
 15. At 500' cut throttle back to 1800 RPM, make a 90° turn ~~out~~ out of traffic, having cleared yourself, then fly straight and level for one mile.

O.K.

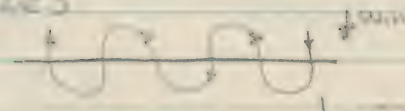
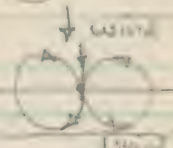
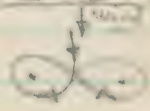
POWER ON STALL

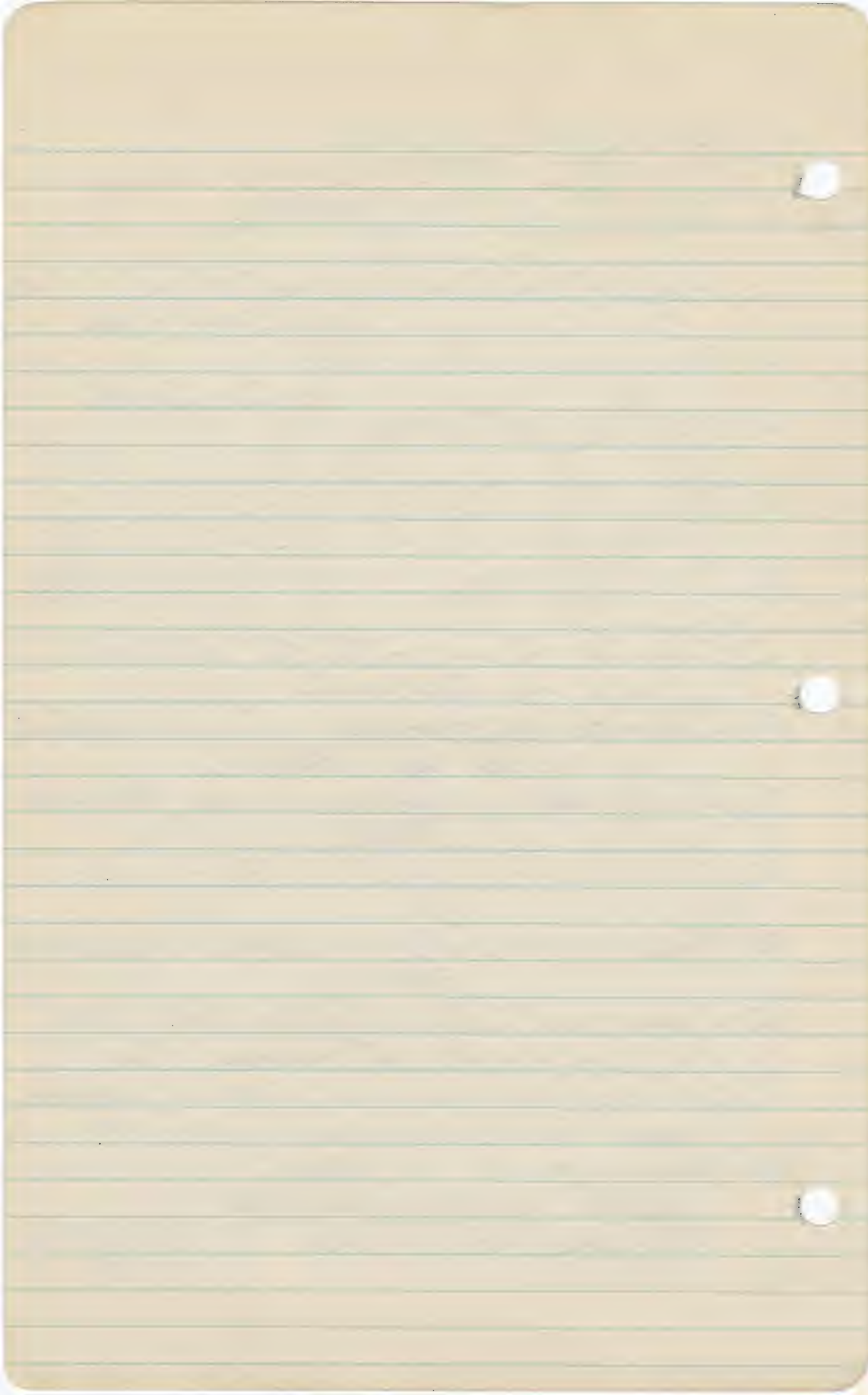
1. Be sure elevation is at least 3000'.
2. With throttle set to give cruising R.P.M. of 1800, clear the position of your proposed stall by doing two 90° turns in opposite directions looking ahead and down for other planes.
3. As soon as you are thoroughly convinced that there are no other planes in the way, keeping the plane headed straight ahead, give enough back pressure on the stick to bring the attitude of the ship to 45°. then neutralize the stick to maintain this angle.
4. As the nose starts to fall take up the slack in the stick by pulling it straight back until it is clear back in the pit of your stomach, keeping the plane headed straight ahead by using the rudder only.
5. When the nose slips down through the horizon push the stick forward to the neutral position and hold it there until the plane picks up some speed and starts to level off.
6. Slowly ease back on the stick and climb back up to a partial stall then level off to regain as much of the lost altitude as possible.

POWER OFF SPIN

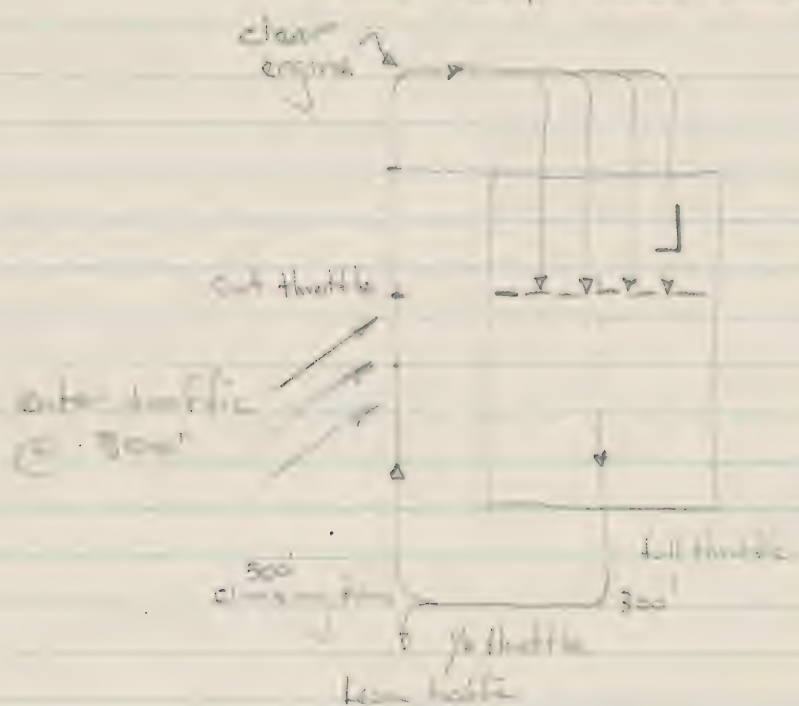
1. Be sure elevation is at least 3000'.
2. Clear the position of the proposed spin in the same manner as you did for the power on stall.
3. When you are satisfied that there will be no planes in the way close the throttle and pull the nose up to an attitude of about ~~30°~~ and ~~as~~ you lose your forward speed and the nose starts to drop ~~kick~~ ^{Push} full left (or Right) rudder pedal and pull the stick back into the pit of your stomach and hold ~~that~~ ^{it} there.
4. One half a turn before you want to come out of the spin ~~Push~~ ^{still holding the stick} full opposite rudder ~~then neutralize the rudder~~ ^{and stick} which bring you ^{at the point from which} out of the spin right on the point.
5. As the plane gains speed and starts to level off give it ~~full~~ ^{full} throttle and climb back up to a partial stall then level off and cut the throttle back to 1800 R.P.M.

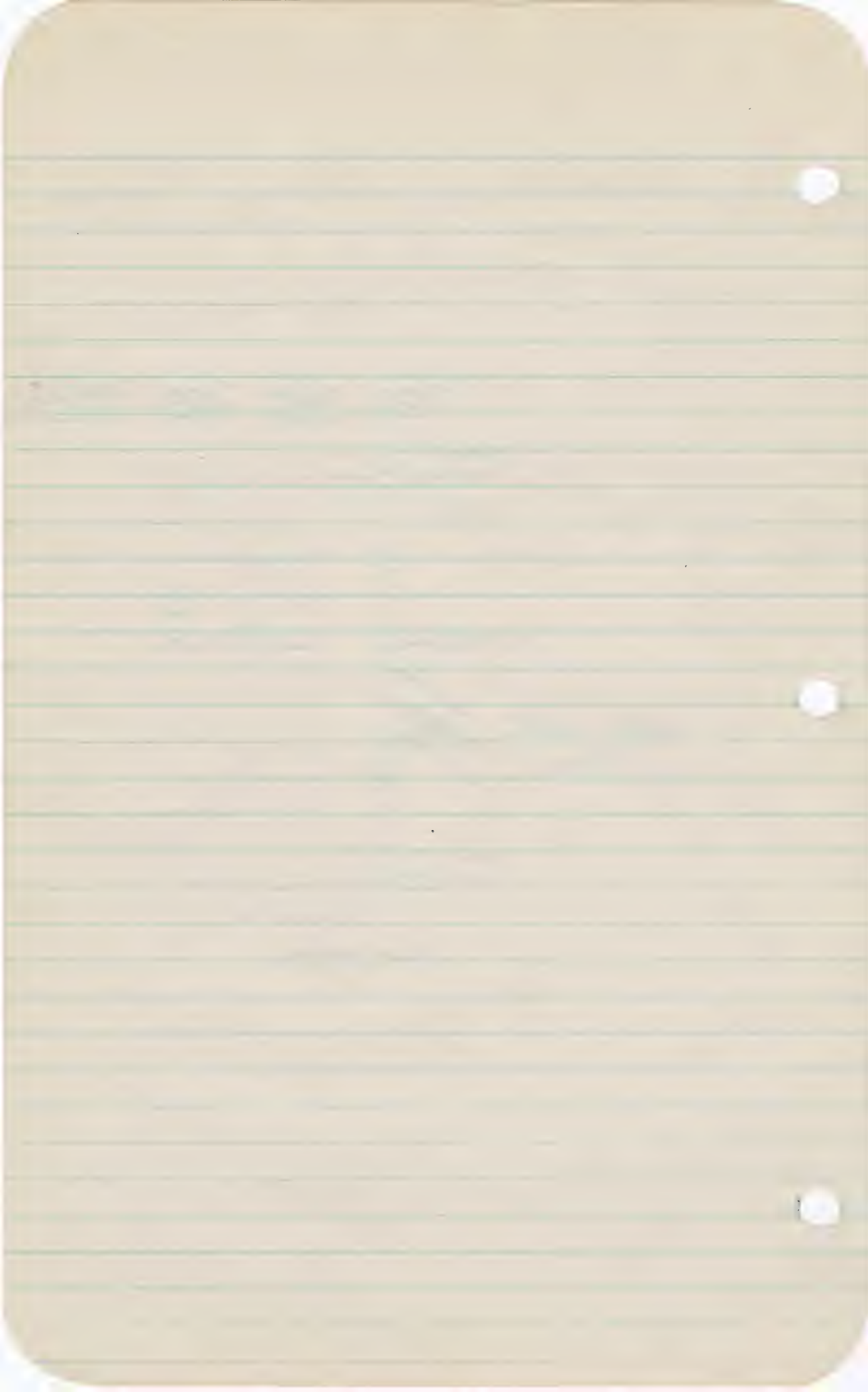
SOLO FLIGHT SCHEDULE

1. Take off and leave patterns.
2. Adjust stabilizer to level flight at 1800 RPM and 500 ft alt.
3. Coordination Exercises
4. S-turns, 1800 RPM 
5. Elementary Lights, 1800 RPM 
6. Pylon Lights, 1800 RPM 
7. Climbing turns - 90° @ $\frac{1}{2}$ throttle to 2000 ft.
8. Chandelles, turning into wind, $\frac{1}{2}$ throttle 2000' to 3000'.
9. Lazy Lights - turning into wind, $\frac{1}{2}$ throttle @ 3000'.
10. Steep turns, 360° , $\frac{1}{2}$ throttle. 3000'
11. Power on stalls to partial stalls, 1800 RPM 3000'
12. Power off stalls to partial stalls, 3000' cut throttle full throttle, 1800 RPM
13. Spins to partial stalls, 3000' to 2000' min. cut throttle, full throttle, 1800 RPM.
14. Gliding turns to 1500' - 90° turns, clear engine every 500'.
15. Fly over field to check T setting @ 1500'
16. Pick



800 FOOT SIDE APPROACH





Example
and the result

B.T.U. = amount of heat required to
raise a lb. of water 1°F.

Diff 778* 1 ft - 778 ft. lb. Sec

1" gas line has about 20,000 B.T.U.

$$1 \text{ B.T.U.} = 778 \text{ ft. lb.}$$

Bottom: Mechanical & Fuel - and require expansion

Example

Volumetric Efficiency - The amount
of charge that actually gets in a cyl.
compared to the amount that the piston
pump could push in to the cylinder

Identifying engines at places by type

Make No. of plane

R - 570 - 5

Plane by

3 in

R - Rotary

570 - Cupid's Arch Displacement 220 570

5 - Type

Approx 1 HP / 3 in Cyl Displacement

SLIDING VALVE PUMP



ROTARY PUMP



Compressor Ratio = Volume of cylinder with piston up compared to volume with piston down.

Limited in compression, highest ratio now about 7:25 to 1

High compression engines more efficient

(+ m.e.p. minus friction)

b.m.e.p. = brake mean effective pressure
= average constant pressure that would produce the same HP as actual varying pressure

1 HP = the energy required to raise 33,000 lbs ft in one minute
= raising 550 ft# / sec

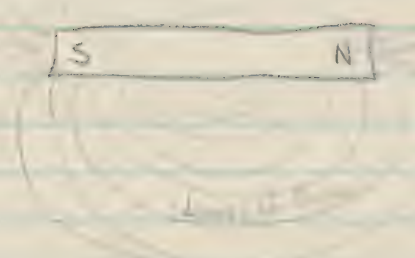
THI P1-29
P 30, 45, 52

THI-40 P 90-95, 100
P 10-13, 15

AIRPORT LANDING STRIPS P 210-214, 149, 150
P 17-9, 10, 22, 23, 24, 25

Magnetic Substances :-

1. Iron - very strong
2. Cobalt
3. Nickel



No lines inside the magnet

Solenoid



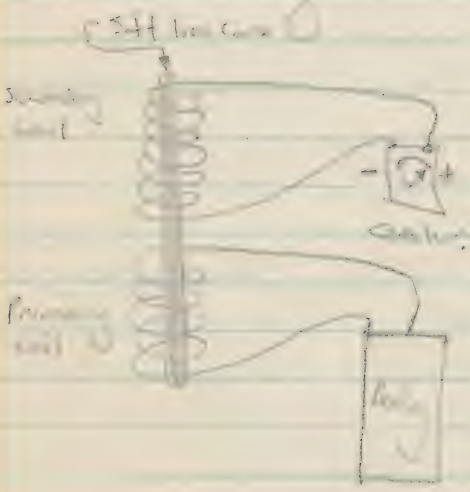
current flows
in same
direction

Left hand rule gives direction
of force on wire when
current is turned.



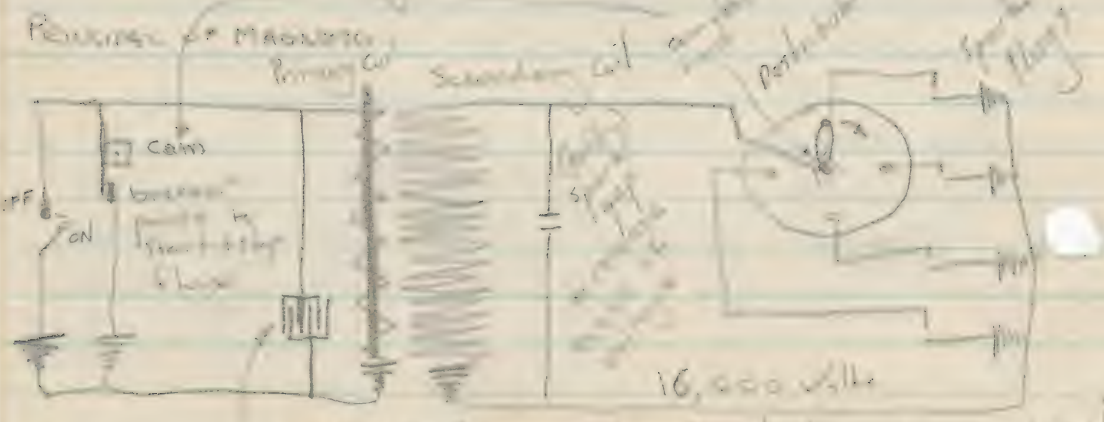
permanent magnet
galvanometer

when coil is
dropped down
and permanent magnet
become the wire
cut the magnetic lines
& flow a current is
induced into the coil
as shown by a
This is principle of



when current is run
through primary circuit it
builds up flux in core
about the soft iron core
which induces a
change into the secondary
while the flux is building
up as soon as the
flux is constant the
current in the secondary

drops to "0". Then when the current is
cut off another change will be induced
into secondary but in opposite direction



condenser (proposed by Branderly from battery & spark)

Magneto



Booster - hand operated magnets to build up enough voltage to get spark to plug while propeller is rotating fast enough to make regular sparks & work fast enough

Spark Plugs - insulation of ceramic
most critical part of engine

1. Insulate plug up combustion chamber, which is hot
2. To be strong and still be insulated
3. Not quibble and still not get too hot

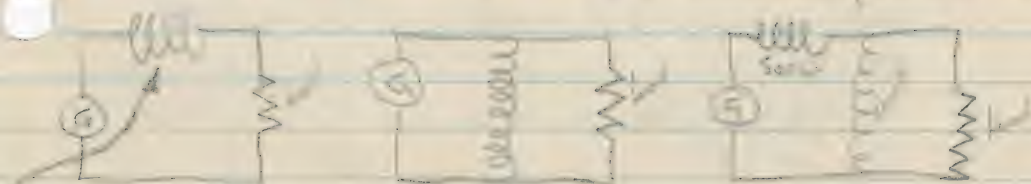
types - hot seating - once in while engine danger gets to hot & then hot for cool running all plug possible will be most hot being important sign

GENERATORS

Series wound

Shunt wound

Compound wound



Note: Manual winding

Lubricants TM1-407 TP 8-14, 15-19, 31

Grand total: 20.417.771.375

- Also helps to prevent corrosion of metal parts.

States:- 1. Solids — graphite, mica, etc.
2. Semisolids — grease
3. Liquid — oil

Ideal lubricant produces max. film $\frac{1}{2}$ min. day.

Periderm - Distich base - middle with 2 wood rays
Pith - base - 2-3 cells

Penalty 5 Asphalt lanes makes best feeds.
 50% [Paraphrase] " Intricate.

Process of getting oils

1. Acid Extension Process
2. Solvent

Properties of Gold Sulphate.

1. High Viscosity - high resistance to flow
measured by Saybolt process
and given Saybolt numbers
S.A. 15. Note table in different ranges
of Saybolt numbers.
Don't confuse viscosity of oil.

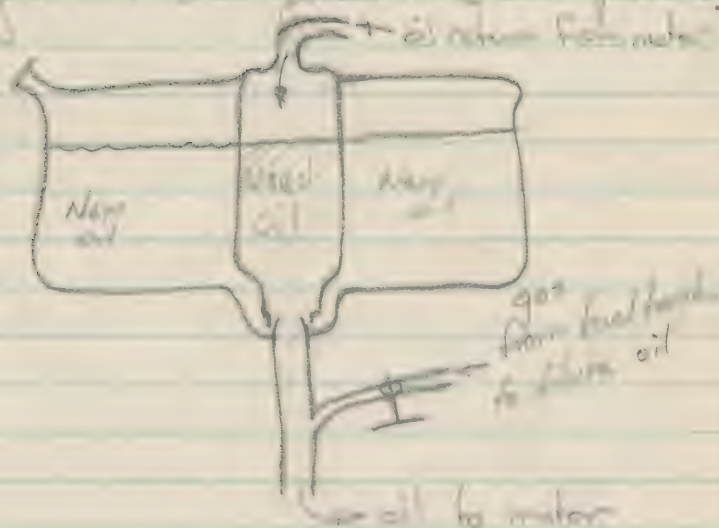
oil level low. No amount of time 60 sec to run the oil at a certain temp. usually 140°F or 210°F.

2. High Flash Point - oil at which water pan should ignite.

3. Low Pour Point - point at which oil will not pour out of oil test tube in 5 seconds.

Oil Drainage Mechanism of Cold Starting

When engine is stopped the oil is drained down the side of the cylinder to lower level for cold start. When engine gets hot the expanding surfaces



Oil change is necessary because of the dirt that gets in the oil just because of oil deterioration.

- Dirt - 1. ^{acid} carbon + water from combustion.
2. dust, etc from air.
3. metal particles from moving parts.

Oil Temp. taken, as oil goes into motor.

Association - Gases which come up
out of well are distilled then
heavy oil is distilled out. These
gasoline called Causing head gas -

Hydrogenation Process

Forces hydrogen into cracked gasoline
to make it more stable.

Qualities

Volatility - { low enough not to get vapor lock -
 { high " to insure cold start.
Octane Rating - high so as not to get detonation.

Purity - avoid sulphur, water, dirt

Available in sufficient quantity

Fuel Systems - Reserve tanks allow 20 min.

Whether is in reserve tank and the
indicator shows empty there is always 20
minutes allowed

TM 1-47
NOTES ON THE ... 24 Nov 52

Measurements - Soil Temp. for water - 10.0°C
2.50 m/sec
In solution - 14.7
Leaf Temp. for water - 10.0°C
In solution - 14.7

... 14.7 $^{\circ}$ /in²
"negative pressure" is a pressure below atmospheric
... 3% in
... 11.7 $^{\circ}$ /in²

... is present in the ...
i.e. when ... is present ...
... is a ... of this.



Relative Humidity - amt. of moisture in the
air at a given temperature
compared to the amount
the air could carry at
that temp. - $\frac{\text{actual}}{\text{sat. vapor pressure}}$

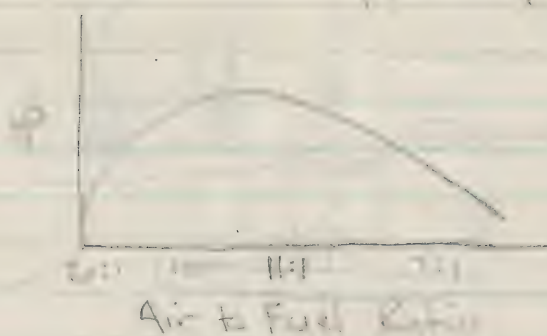
air temperature above the ... capacity
of the air increases and ...

Latent heat of vaporization - heat it takes
to change liquid to vapor.

i.e. it takes 1 calorie to raise 1 gram
of water 1 $^{\circ}$ centigrade but it takes
536 calories to change 1 gram of water
at 100 $^{\circ}$ C to steam at 100 $^{\circ}$ C
latent heat of fusion of water - 80 calories

The lower the atmospheric pressure
the lower the combustion efficiency

Fuel - rich
mixture ϕ



To tell proper mixture

1. With constant throttle setting set mixture control to rich best E.P.M. (not a good averaging pitch prop)
2. Use exhaust gas analyzer
- * 3. Check for highest manifold pressure (on averaging pitch prop)

Leaving uncorrected by heating air intake so that the fuel vapor is injected the mixture before will not freeze.

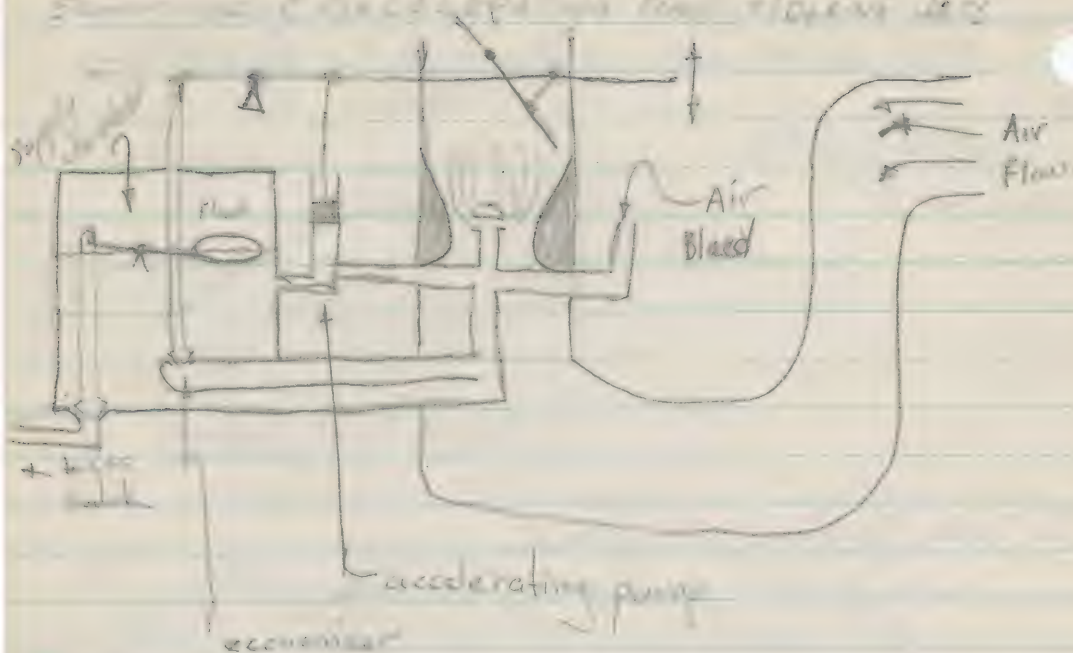
Heating air to high is undesirable

- Because 1. Mixture too hot when entering cyl. and therefore danger of detonation
2. Air expands when heated
- Volumetric Efficiency is lowered

Overheating makes timing (pitch prop) (P.C.H. opening)

1. This late time mixture rich cylinder supercharges, also not necessary
 2. Engine will idle very well
- Don't need to control flash point to carb.

Engine Characteristics and Flow Diagram



Types of charging

Pressure constant - T & V vary proportionally

T constant - P & V vary inversely proportionally

V constant - P & T vary proportionally

Types

1. Roots

2. Vortex

3. Centrifugal $\star$ Used Mostly

Location

Internal - between Carb & engine

External - " Carb & air intake

(Forced exhaust driven) $\rightarrow$

Gear driven - 1. easier to maintain

2. " " regulate

3. lighter in weight

4. may strip gear if throttle is jammed

TM 1-412 U.S. Army 16, 10, 22

N 25 29 30 32 34 36 38 40 42 44 46 48 50

Ratio of engine RPM to prop RPM is up to 10:1

Also at temp -273° Centigrade

Exhaust down - to efficient motion and noise
in altitude.

2. Cannot be lost by pulling
on throttle.

3. It takes much more
fuel than in sea level
work maintenance.

PROPELLERS:-

Types - Pusher
Tractor

Definitions

Blade face - face that works on air
(part of prop. pitch and twist)

Prop Chord - leading edge to trailing edge

Fixed Pitch - cannot be varied

Adjustable (ground) - variable on ground

Controlable - changeable by pilot or ground

1. Hydraulic 2. Electrical 3. Mechanical

Stresses - Bending & Thrust

Torsion - Centrifugal force

Torquing - tends to twist prop to
low pitch

Effective Pitch - angle which airfoil has
 geometric Pitch - angle plate should go

Feathering - movement pitch

Full feather - 90° pitch

advantage is that blades will not
 stall in flight.

Propeller Control -

greatest reason is Feathering

Advantages of Constant Pitch Props.

1. To use engine more efficiently.
2. To use propeller more efficiently.
3. To adjust for various attitudes
4. Full feather features

MAKES OF PROPELLERS

1. Lycoming - Smith - Chesbrough

Mechanical - can be changed
 in operation by a solenoid which
 is operated by pilot

2. Curtiss electric - very high gear reduction (4000 to 1)

& electric motor on hub of prop keeps
 a constant R.P.M. by changing pitch
 of prop to keep load on engine the
 same. Manually

Governor control should not be left on
 continuously because of wear and tear
 on motor which will be present permanently

Low P 12 2 pitch

1. Use two pitch on one on a gearbox
2. Use main pitch to start and control.
Blade angle changed hydraulically
but controlled manually.
3. oil pressure used to turn for low pitch.
4. Counter weights used to turn back to high pitch.
5. gets about 10° change in pitch.

Hamilton Constant ^{Speed} RPM Prop

10° change in pitch
uses spring and oil pressure (bore prop)
regulated by governor.

Prop Pitch indicator

Hamilton Hydromatic

gas - gasol (low to mid)
constant speed

Anti-knock & pressure control
Do not use - very noisy & not use

CONTROL SYSTEMS

Engine Controls

1. Throttle
2. Choke Control
3. Carb. Heat
4. Governor Throttle
5. Ignition Switch
6. Ignition Coil

Throttle stops preventing engine to reach top
of fuel cut - and cause stalling.

Throttle open and close butterfly valve.

Friction clutch prevents throttle setting
from changing.

Cold weather starts - open throttle from
ignition switch - 3 or 4 times - pulled in
at each position & full throttle

	% HP	Manifold Pressure	Exhaust Pressure	Timing	Engine Response & Performance
Low Gravity	67-70	22-25	Low test	bad	Poor
Normal "	70-80	26-28	Ed test	average	Good
High Gravity	80-87.5	27-31	26-Ed	none	Excellent
Very High	87.5-100	31 -	Rich	none	Emergency only

above 15,000 no possibility of fire

PRE-FLIGHT

Outside Para

1. Check Chocks
2. Check Pumps:

3. Check Tires & deflation

4. Check Struts

5. Prime Fuel Tanks & split tank each tank

6. Take off Airspeed Cover

7. Turn prop & fuel line. Man switch off
circuit breakers to all.

8. Inspect parallels.

Cock Pit

1. Zero Stabilizers

2. Flaps Up

3. Check Instrument panel
white lines line with casing

4. Check Control cables & bottom
of cables for pinches that would bind

5. Alt. Zero

6. Check Fuel Pressure Signal

7. Warm up.

DAILY

1. Remove Gauges & check under

2. Oil Prop & check for cracks

3.

BT 13A Dyn Tech Order 02-10AE-2

450P @ 2200 RPM

Has a blower ratio $10.12 \approx 1$

compression ratio $6 = 1$

engine 635 lb.

Carb. No. NA-R 9 B

700 Right hand

Mags. Single Base (SB) - 9 R

Firing order 1, 3, 5, 7, 9, 2, 4, 6, 8

Front tire 30"

Rear tire 36"

Aircraft Tech order No. 01-50 BB-2

Engines - base

Primary motion Single row radial (P)



1, 3, 5, 7, 2, 4, 6, 8

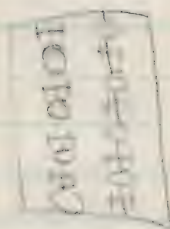
Twin row radial (P)



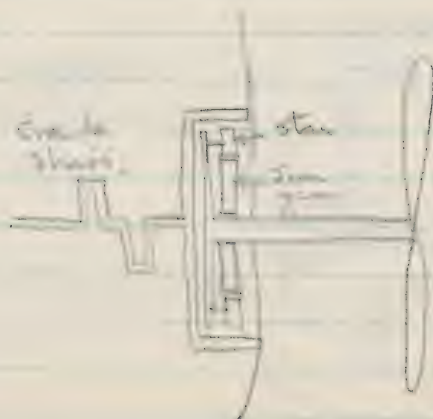
1 2 3 4 5
6 7 8 9 10
11 12 13 14

1, 10, 5, 14, 9, 4, 13, 8, 3, 12, 7, 2, 11, 6, 1

Engine alloy - forged in die cast.

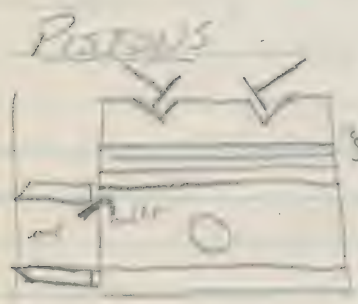


Planetary gear



Eng. Main Piston - 2 piece crankshaft
 1 pc. master part of connecting rod.

Turn Low Piston - 1 piece crankshaft
 2 piece master part of connecting rod



Because in type of piston for engine
 2 pump rings

simple piston

Cylinder - 2 piece type

slit back for aluminum head
 and frozen into it - ^{head} secured

Valve and valve mechanism -

Can plate connected to prop shaft on R. engine
 2 valves on piston



valve when piston moves
 valve is about 1/2 inch

Lubrication - Dry sump, pressure,
and spray system.

Blower distribute fresh air to
cylinder

Exhaust system - mechanical pressure.

Altitude V-1710-11 + old car engine

12 cyl., 6 cyl. banks, 60° bet. banks
1250 HP at 2500 RPM take off
Low altitude engine.

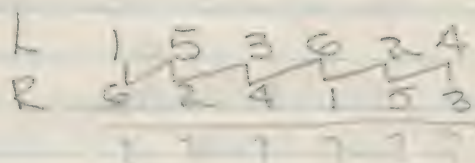
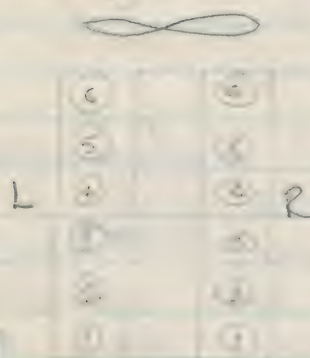
Cooling System

1. Used Pressure or ethylene glycol
High boiling pt. - Low freezing pt.

2. Coolant starts from ^{antifreeze} pump goes
thru cyl jacket, cyl head (temp)
radiators, blower, back to pump.

3. Min. cyl head temp 55°C max 125°C

Timing, numbering, sk.

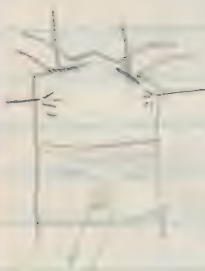


1, 6

Magneto - 1 double unit + distribute for each
(2 singles in radial) tank
located

Spark Plugs - 2 per cyl - 1 intake & 1 exhaust plug
 exhaust plugs fire 6° before
 intake plugs

Distributor - on for exhaust plugs on for intake
 turn at 1/2 in. gear on the
 crank shaft - one at rear gear lock



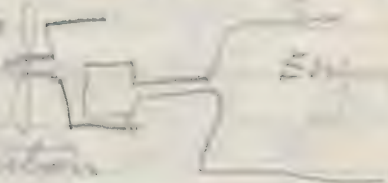
Staggered spark - exhaust 6° before intake
 mixture leaner and lower
 pressure on exhaust side due to
 incomplete scavenging

Booster Finger - retards spark
 while starting engine to guard
 against engine kicking back.

PROPELLER REDUCER, ^{Engines} 2 to 1 ^{Prop}

greater HP, Prop spinning

Reduction where
 engine & prop both
 turn in same direction



Prop & engine
 in opposite direction



Cams, Valves etc

2 intake & 2 exhaust valves used
 both working simultaneously
 from same rocker arm (Y shaped)
 where there is only one exhaust
 and one intake cam per
 cyl.

Oil System - pressure sky engine
system
clean slimmer wash
between pump and bearings

Carburetor - High pressure ^{fuel} pump
streaming PD-12-B
12 to 15 lb fuel pressure

Hot Blower section hot air, sync char
thermo low alt engine.

STARTING -

1. Throttle 800 - 1000
2. Mixture carb. idle cut off ^{while engine}
3. Inertia pump - 5" fuel pressure
4. Fuel engine 2-3 strokes
5. Engine start then
adjust to full rich.
6. When taking off use full
rich to 3500' then put on
auto rich.

120 gal. per hr
12 gts " " 60-70° pressure

CARBURETORS

BT 104

NA-8-7-3-1 - 2

1. 2 1/2, 3 1/2
are used to take care of fine
piston.

Full on take should be 11-1 to 17-1
throughout engine speed and acceleration.

On take gives a more uniform flow
taking - rich mixture

Economiser - enriches mixture & keeps
engine from overheating

Old type - needle valve type

New types - piston type
manifold pressure type.

Judders Acceleration is affected by throttle
comes in mixture of air

Accelerators

1. Well type - well in ^{and} nozzle
2. Piston type

Mixture Control -

1. Needle valve type
2. Air port type
- 3. Back suction type - must seal and
not leak.
Reduce effect of ^{di} pressure
in float chamber
4. AUTOMATIC - Ballons which operate
needle valve. Ballons which is
operated by change in atmospheric pressure.

Detonation = instantaneous combustion
of last part of charge due to high temp
and pressure.

Pre-ignition - firing of charge before proper
time - hot engine.

Auto Ignition - igniting charge spontaneously
or without spark.

Cool Temp gauge should be 2° to 5° C
for good operation. Lower temp than
 2° indicates danger of icing.

JETROBORG INJECTION CARB.

1. Not affected by moisture
2. Won't ice up.
3. Heavy in weight
4. If throttle pump is pumped to
open a 5" fuel pressure main
chockage might will discharge
fuel and hit a fire hazard

FUSILAGE CONSTRUCTION

Steel tubular frame - Cor-mulibimium

50mm steel

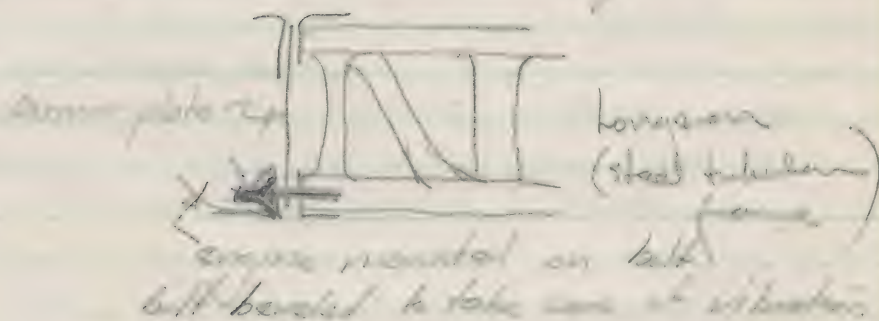
Insulated frame 1st oil painted
outside " " aluminium varnished
cadmium plate (Navy)
to prevent corrosion where joints

Monocoque - in segments (true monocoque built by plate)

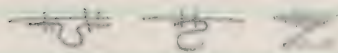
True " "

Bulkheads - Rein. sub-stance internal pressure to plates
Formers - light bulkhead-like structure
Rings - form contour of frame light domes
Stirrers - reinforces spars
Skins - (Plated) aluminium
they need a coat of pure aluminium
on each surface -

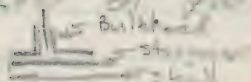
Bulkheads - Armored with 50 cal plate rows



Stringer shapes



Stringers 2nd of front edge of Bulkhead



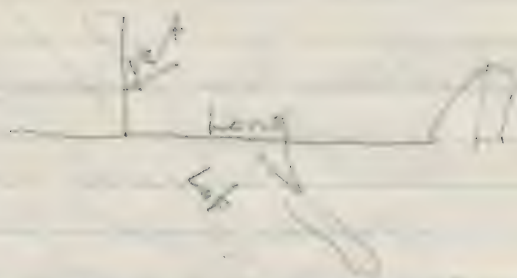
Flotation - in water - 35% excess required
except for single phase fighters.



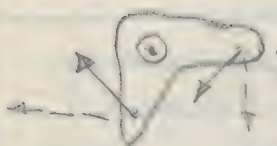
small hole to drain out condensate
and squelch solvent fumes
in wing.

TAKE time to move them in direction
that it is desired to move in air element
Ex. At very heavy want to move
it up. Move both up. Action now
down and wing moves up.

OK/B



Ball crank - gives a change in direction
which a positive reaction
used on throttle, fuel
linkages, sustains control
etc. Control linkages
from cockpit to engine



FUEL SYSTEMS (PREFERRED)

1. Tanks - made to withstand an internal pressure of $3\frac{1}{2}$ to $4\frac{1}{2}$ #/sq. in.
2. Baffle plates to prevent sloshing.
3. 1st Compt. stage - Inverted Flight Chamber - holds enough fuel for ± 5 min. of flight.
4. Pump - driven by idler's impeller. Finger screens. Capable for non-corrosive spirit.
5. Reserve tank - good for 20 min. of flight at full throttle.

B. Gas. Feed Lines - seamless copper tubing or aluminum alloy. Marked with red enamel band. Connected to Gas switch.

C. MAIN STEERING

D. Fuel Pump - A Telling you to engine down fuel pressure. $3\frac{1}{2}$ to $5\frac{1}{2}$ #/sq. in. self priming sliding vane type pump. By pass to maintain $3\frac{1}{2}$ to $5\frac{1}{2}$ #/sq. in. full pressure and no more.

E. Wobble pump - hand driven pump has a ball & gravity valve above to prevent fuel from running back.

F. Fuel Pressure Warning Light - lights below fuel pressure of 2 #/sq. in. Warned by diaphragm spring against fuel pressure.

G. PRIMER PUMP - to prime engine cylinders for starting (supplies fuel only, becomes valve 4 are inverted)

Caution: be sure primer is locked because engine will pump gasoline into engine.



SUPERCHARGER - increases manifold pressure -

1. RAMING AIR INTAKE
2. EXTERNAL SUP. on an inlet side of Carb
3. INTERNAL SUP. between Carb and engine, gives greater than atmospheric pressure
4. INTERNAL BLOWERS - gives even greater than atmospheric pressure (but distributes charge more evenly).

INTERNAL SUPERCHARGERS - 2 speeds
gearbox to engine.

2. Port in through output engines
3. Friction clutch to release stress on rapid acceleration & motor.

EXTERNAL SUPERCHARGER (TWO)

1. Exhaust driven
2. Waste gate regulates pressure
with baffle back which blows
turbo.

2000 RPM @ 70 in. ft
above which manifold pressure
1" g. running any 1,000 feet

PROPELLERS

Danger

Twisted air foil

Propeller failure due largely to
vibration

Stresses

- 1.
2. Tensile - Centrifugal
3. Torque - twisting moment
tends to twist
like low pitch

Fixed pitch props - compromise between
pitch needed on takeoff and for
cruising.

10° pitch angle

Hamilton Standard 2 position - 37.134

low for take off

High " " landing

5 1/2 inches

Engine oil pressure 60 to 90 P.S.I.
Changes prop from high to low pitch.

Control lever works valve
which opens for low pitch allowing
oil into cylinder

2. Closes off oil pressure but
allows oil to drain out into
sump on counter weights path
prop into high pitch.

3. When prop reaches complete
high pitch it closes valve
completely.

ADJUSTMENTS

Adjusting screw

4 pins in prop path.

Materials & Cost

Blade - Helium shock - pressure
balancing & stress.

Thrust ring - Full solid prop
& on full ball bearing.

Piston - steel with oil tight
gasket.

Cylinder - aluminum. steel lined.

HAMILTON JTD COVET. 3700 (and 2PM)
20" pitch range (approx)

Spools used to set engine weights

Control Speed Control Unit

1. Before start pump 150-200 $\frac{1}{2}$ inch
2. Governor or flyweight starts to engage and connects to oil valve.

Phases 1. On speed select 3000 RPM
pilot valve blocks all
flow of oil to or from
flyweight governor act.
of unit.

2. On speed - governor
slows up of unit when
allowing oil into power
pilot.

3. Over speed - governor
speeds up. Governor valve
permitted oil to come
from pump which gives
limited higher speed.

Manual Control & Coast if fuel control
unit speed or interlocks control
used for these phases.

HAMILTON HYDROGRAPH

FEATHERING PROP.

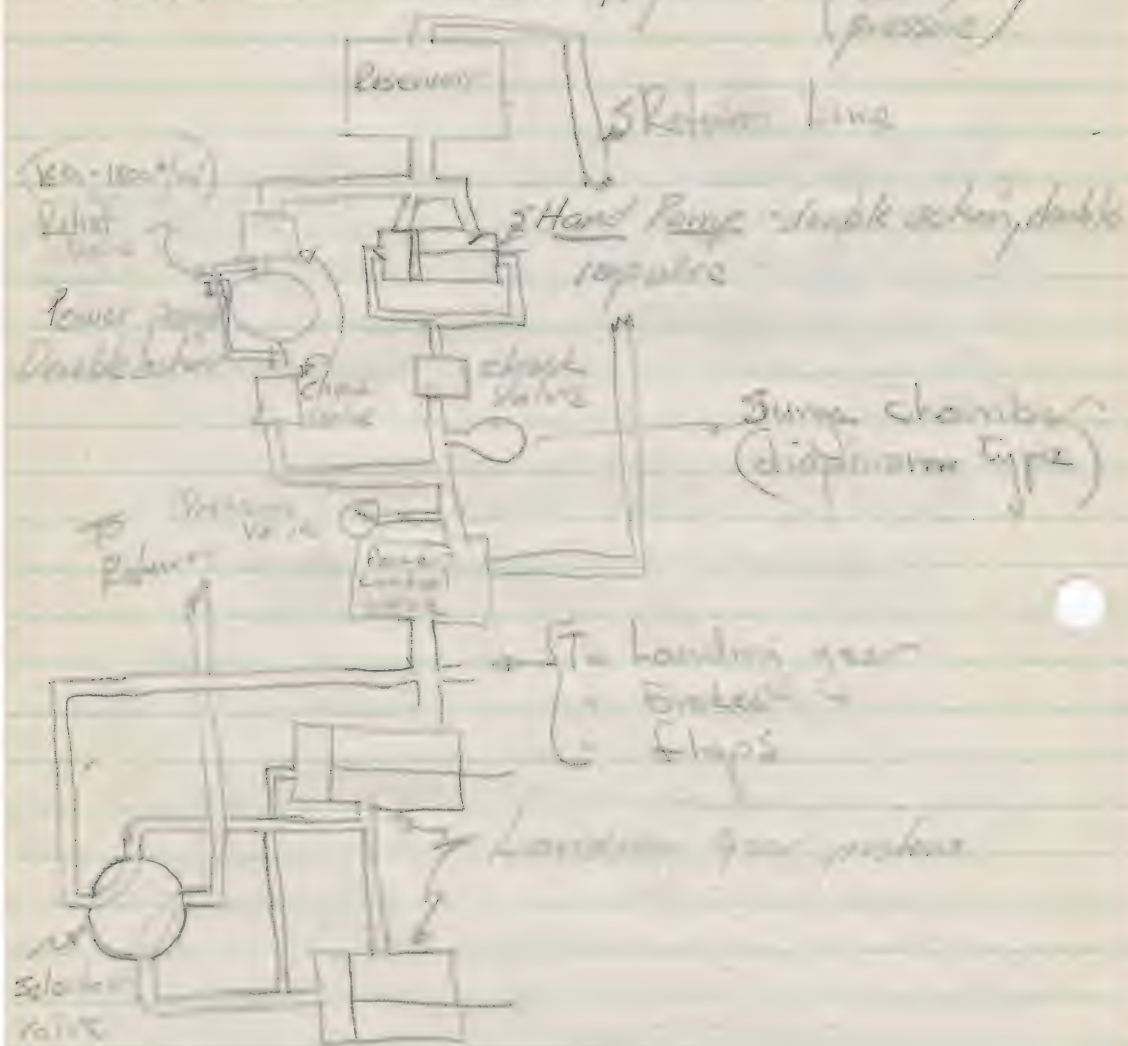
water available at pressure given
by pumping with the pressure (gpm)
this ^{high} pressure is about to
full feather prop and other prop
not

CURTIS ELECTRIC

Test to have

HYDRAULIC ATTACHMENT

LANDING GEAR: Hydraulic (5000 psi pressure)



Neoprene - Composition rubber used for lines

Landing gear lock in place when lowered.

When throttle is cut and alt. below 1000 ft. a horn blows to remind pilot that landing gear is not down & locked.

Shock Struts 1000 $\frac{1}{10}$ " pressure maintained
with air pressure.



Wheels - 1. Split wheel

2. Truck



2. Drop Center

medium



3. Removable fange - like plunger
long plunger in type wheel

Tires - 1. Smooth type

2. Treated

3. Strengthened

Inflation

1. All have deflection marker to
indicate air pressure.

2. on hard or rough field over
inflation tires 25%

3. on soft fields under inflation 25%

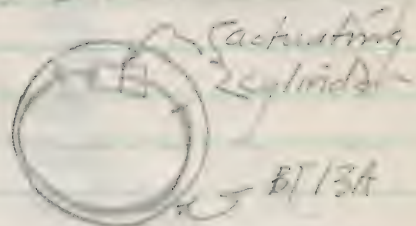
BEAR - usually single or double shoe type

Single Shoe or servo brake

gears rotating on one common axis



Double Shoe
Brake



Single Shoe Brake

One master cylinder per each brake

Multiple disk type



Small master tube

which upon expansion

it pushes against the disks to stop the car.

INSTRUMENTS

Foot Pressure	3-5 $\frac{1}{2}$ in
Oil Pressure	20-30 $\frac{1}{2}$ in
Oil Temp	over 40 $^{\circ}$ C

TRICKS TRAINING

STAIRS

1. GO DOWN

A. GO DOWN 5-1000

Hold rope with the left hand, hold the
right (to the wall) (bottom) for extreme
stability. Under hand for more control.

B. GO UP WITH THE ROPES

1. Turn back over the rope to the
2. Go back to 3000.

2. OVER PULLING - to catch and go in climbing

A. Switch off and take the rope
turn prop over a few times
to show the clear signal
of down now go.

B. CATCH - PULL - RELEASE

1. The pull stroke is a power
2. Fast in stroke
3. Hold on pressure with the
pump before pressure.

3. TRICKS TO THE TOP

A. Tug the rope and pull
the rope to the top.

B. Pull the rope back to the
position I think right.

4. ESCAPE STICK

A. Rock Popper - hold 1 foot

B. Over the rope, pull it
pull about 1 foot.

C. Do not suppose once released
enough to start the rope.

5. Control

A. Have engine under 2
gas handles, each
control is 1/2 of each
has two the lower not
releasing a gas.

B. Release gas control goes
to play water tank.

6. On Exhaust Low

A. If there is no vacuum in
oil pump for 1 sec. shut
engine off.

ENGINE TROUBLE

1. Engine trouble indicators

1. Low RPM

2. Vibration of engine

3. Low oil pressure

4. Color of oil - 1. Black smoke Rich mixture

2. Yellow smoke - Lean

3. Blue smoke - oil mist

4. White smoke - excess oil
consumption

2. Systematic Elimination of Trouble

A. Symptoms of trouble

1. Idling speed

2. Cruising speed

3. High

B. Classifying trouble

1. Local

2. General

C. Diagnosis of Trouble

1. Ignition
2. Carb or fuel system
3. Acting
4. Compression
5. Cooling

Local Location Toward

1. Due to idling engine too long
2. Choked by ~~transmission~~ ^{carburetor} ~~carburetor~~ ^{up to full gear} (1500 rpm)
3. Spark plug because fouled with oil because the get cold causing rough engine performance any spot

General Location

1. Spark Retention - ^{spark plug} ~~spark plug~~ ^{also} ~~also~~ ^{at} ~~at~~
2. Carburetor - ^{shorted} ~~shorted~~ ⁱⁿ ~~in~~ ^{out} ~~out~~ ^{open} ~~open~~ ^{margin} ~~margin~~ ^{and} ~~and ^{font} ~~font ^{are} ~~are~~~~~~
3. If Carb is in open circuit on any way it will run on that way in off position.
4. Water - ^{from} ~~from~~ ^{through} ~~through ^{engine} ~~engine ^{running} ~~running~~ ⁱⁿ ~~in~~ ^{the} ~~the ^{engine} ~~engine ^{is} ~~is ^{present} ~~present ^{up} ~~up~~~~~~~~~~~~~~
5. A closed exhaust valve will not let out at all the steam.

IGNITION SYSTEM - MAGNETO

Source: *Car Engine Principles*

amplitude - 0.5 - 1.2 - 4

Base - 1000 - 1500 - 2000

Type of Magneto

1. Station coil - coil wound on soft iron

2. Inductor type - magnet on soft iron

→ 3. Rotating magnetic type - best

A. Used on fuel aircraft engines
B. Used on induction system



as the breaker points
open, collapsing the
field in the primary
winding, a high
EMF is induced in
the secondary.
Mutual induction between
the primary and secondary
windings.

Secondary - light coil many turns
→ gives high voltage, low ampere

Primary - heavy wire few turns, low
voltage + high ampere

Condenser - prevents arcing at breaker
points by storing charge

Left main fire exhaust plugs
at main fire intake plugs
In Cadillac - 2 single mag. distributors
included in mag. distributor
timed to

In V-type - double mag.
distributors externally built
& timed to engine
Left main fire exhaust plugs

For synchronization with starter draw
a booster system to give spark to
plugs at start until RPM reaches about
160-200 when mag. comes in.
gives at 10-15% } Hand operated booster - PT
Battery }
1/6 ohm }

Delayed interrupts primary circuit
Booster attached to different finger
in distributor which fires light after
top dead center reaches a mag. finger
fire plugs before top dead center.

Plugs: Insulators

Barium - Crooks & Lunt

Wien - used on aircraft
high thermal conductivity
high resistance & dielectric

Ceramic - Spinel type
silica glass

2 types

Hot - low output engine - low wear

Cold - high output - low wear and low
friction & low wear

STARTERS

4 components

1. Friction band - to hold pump piston
2. Compression fuel
 increases in compression, sign,
 expand. Heat and pressure with
 increase of cylinders

SECOND STARTERS

2. 1st media

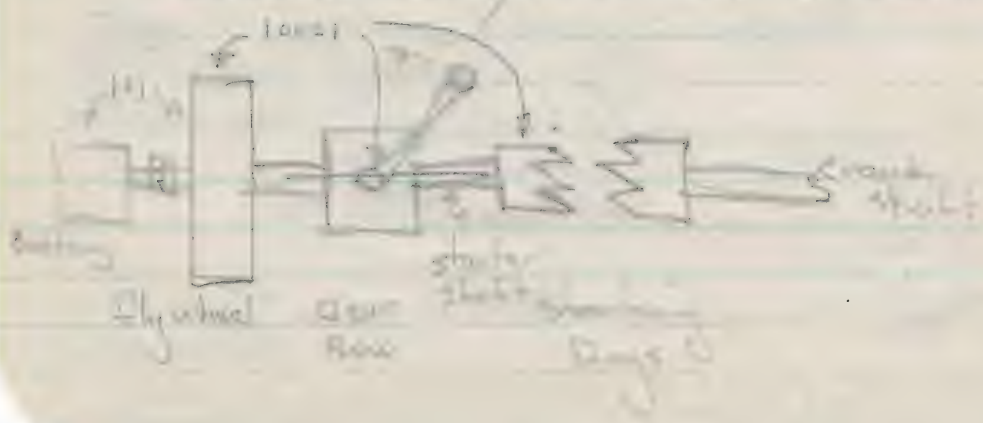
2. In previous band & Battery media state

3. Carriage type

Hand

WET A STARTER

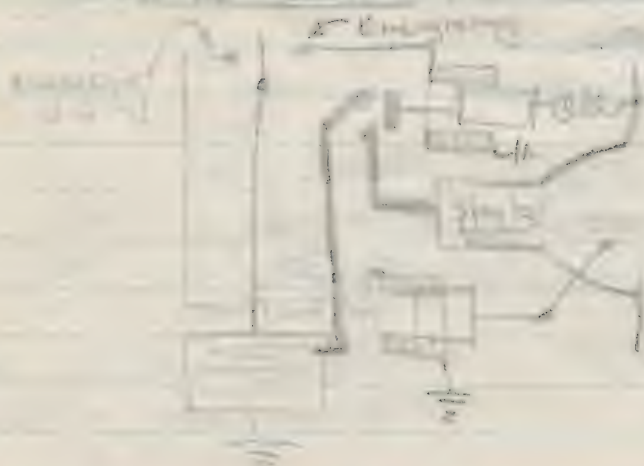
1. Flywheel connected to hand crank
 then a series of gears and planetary
 gears to get a ratio of 100:1
2. Ratio between flywheel & starter
 shaft is 100:1
3. Dog on end of shaft shift and
 crank shift mesh to start motor



EXPOSED LUCERNA INDICATOR

1. 12 volt source with electric motor will continue to run as long as RPM is as long as current is applied. Motor should not be exposed less than 20 sec.
2. Motor connected (1) by days during exposure to physical. To do it, connect a switch from until physical has completely stopped. Day between motor & physical will be stopped. To stop, anyone with small 24 volt electrical supply stop.

How to Connect



switches
and to
eliminate
hand
from
cable to output.

CARTRIDGE INDICATOR



Patent is bought into cylinder.
Shall be from sealed
- Patent - and from
@ 240 rpm - slowly
low speed motor system
with motor output



Series On Line Type Generator



Self exciting type

CONSTANT VOLTAGE REGULATOR



Voltage Coil
Working Voltage $\rightarrow 14.25V$
Cut in cut off voltage $13.50V$
Voltage windings
break point
Rheostat cut
Dut coil
Forward battery (1917)
to generator system

Volt meter connected in //

Ammeter connected in series

Trickle indicated by reading on
ammeter + voltmeter

Voltmeter should read 13.50 volts

→ 1. Normal voltage reading + 50 amp reading
Batteries at 100% full - held open

→ 2. BATTERY - inspected every week

if battery is low - immediate re-charge

→ 3. Battery Charging

1. Discharged - 1.150
2. Half charged - 1.150 to 1.200
3. Full charged - 1.275 to 1.300

Multi-voltage ship's generators and
batteries connected in parallel.

Fuels - 32 white - found in place
emissions - gasolite

Gasoline - 1. 32. Run - fractional distillation
for purification

about 10%
mixer in 32
32 Run - 2. Cracked - white solid
broken down - broken white
& not thick - however, when
mixed with 32 run, clear.

3. Absorption - gas in vapor
form absorbed in oil.
Oil then distilled in
very white & mixed
with 32 run - called
natural gas

Pyrolysis - with air being
2-3 Methylol - intermediate
Pyrolysis - low pressure

130. Octane - 100% octane being

Value Low - caused by highly volatile
gas - 3

Carbon - gases distilled at higher
temperatures - yields more carbon.

Dehydration - almost instantaneous
combustion of last part of charge
due to increased temp &
pressure.

Due to low octane in
low conversion part

Pyrolysis - reaction of the charge
before which due to
contact with something
hot.

Exhaust valves get that
hot with a few fresh gas lines.
Carbon deposits & some
that of fresh plugs. } being

Petroleum + Pyrolysis fuel result in

1. Carbon in exhaust
2. Ring of R.P.M. & pressure
3. Whiteish plume from
exhaust.

Gasoline Tests

1. Volatility -

2. Paper Test - gasoline - cloud

3. Corona Test - disk

4. Burn Test - compressed - gas
gasoline - accelerated igniting

5. Labeled - Gas - lamp - and
flame - passed thru

6. Acidic Test

7. Burn Test - paper tested
and chemical solubility only
in water - marked

8. Knock Test - Octane Rating
determined by comparison
with a known mixture of
isooctane (A) heptane (C) or
std. gasoline in spark
engine.

Anti-Knock - Term - also used
used - smooth - Harkness is
very descriptive.

When going where is not used
Hid. No. - keep up engine
house - Description

Lubricant - Mineral oil, grease,
petroleum

Solids - Graphite, graphite, Carbon.

Semi Solids - Greases -

Liquid - Oils -

Tests -

1. Penetration - penitence test
2. Gull test - asphalt test
3. California - asphalt test
4. Hot test - mixed test

Pen. oil test lubricant.

Asphalt test using 120 = GC IAE
Tests

Seal & Viscosity Meter use -

Flash Point - heat sample in open
dish until flash appears
that is flash point
Heat up higher than
engine operating temp.

Pour Point - sample cooled & shaken
if it does pour then pour
it pour from open dish.

Carbon Loss CT - determined by
suspending oil + chalk deposit
Acid Test -

Emulsion Test - inject oil + water
and then see if they will separate
in 5 days

Oil Requirements

1. High Viscosity
2. High Flash point
3. Flat wear test - Comp. characteristics
4. Low Pour Point
- 5.

Reclaimed oil - oil that has been
used and then ^{dist}ill removed

Analysis of oil (4) in seal test nos.

77 -

95 -

120 -

140 -

not a good oil for piston
+ ring pack

Cable

Floor Type NA

Power Type PT

Lat. 17° 15' N - Long. 105° 15' E

Water 3000 ft. depth

1. 1000 ft. depth

2. 1000 ft. depth

3. 1000 ft. depth

4. 1000 ft. depth

5. 1000 ft. depth

6. 1000 ft. depth

7. 1000 ft. depth

8. 1000 ft. depth

9. 1000 ft. depth

10. 1000 ft. depth

11. 1000 ft. depth

12. 1000 ft. depth

13. 1000 ft. depth

14. 1000 ft. depth

15. 1000 ft. depth

16. 1000 ft. depth

17. 1000 ft. depth

18. 1000 ft. depth

19. 1000 ft. depth

20. 1000 ft. depth

21. 1000 ft. depth

22. 1000 ft. depth

23. 1000 ft. depth

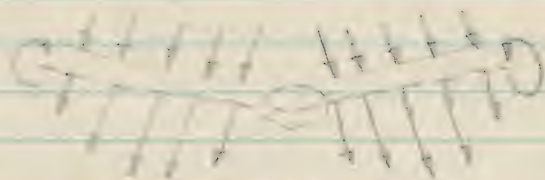
24. 1000 ft. depth

25. 1000 ft. depth

THEORY OF FLIGHT

Propellers

① looking at a propeller
in circulation after the
propeller has been started.



② The air is that
in the circulation
after the propeller
has been started.

The air is that
in the circulation
after the propeller
has been started.

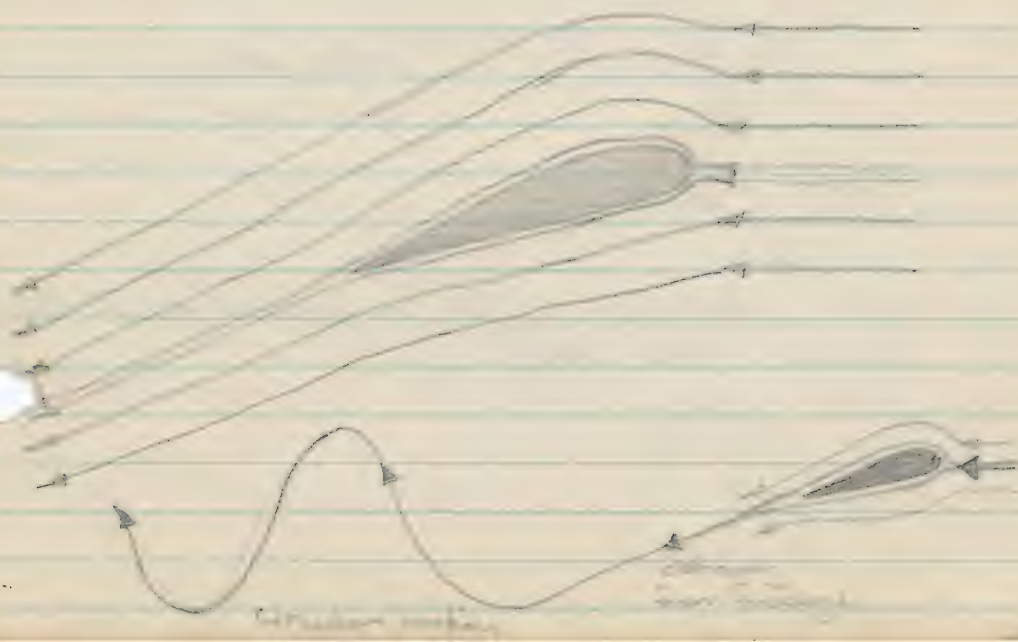
until acquired
by friction.

left wing

right wing



Flow about an Airfoil



Assume air flow is 100 ft/sec
 The air is at standard conditions

Notes: - Underwood { Top diameter 19.45 { 9.12 inches
 To P 43 { Lift coeff. - 1.0 (approx)
 Drag coeff. - 0.5

The air flow over the surface of the rock is
 disturbed by friction with the rock
 and internal friction for a height in
 feet equal to 3.38 inches the velocity of
 the wind is 11 ft/sec.

Ref diagram P, 45 (hp)

Lift Coefficient (C_L) is a number
 which when multiplied by the dynamic unit
 pressure calculated at a wind velocity of 10
 will give the lift per unit area.

$$L = C_L \frac{\rho}{2} S V^2$$

ρ for standard conditions
 $\rho_{air} = 0.002378$
 $\downarrow$
 32

$$L = \text{Lift (lb)}$$

C_L = constant

ρ = mass density of air = 0.002378 for std conditions

S = surface area (ft^2)

V = wind velocity (ft/sec)

Example: -

115

Rayonide Model - (P.H.) models of the
 relative control surface to wing size, and
 ratio of wing with winged actual
 size.

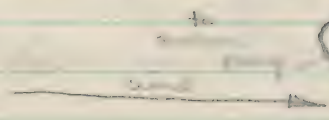
$R.H. = 42\%$
 H

$R.H. = \text{Rayonide No. (model)}$
 $V = \text{Velocity of air (ft/sec)}$
 $Z = \text{Chord of airfoil (ft)}$
 $\rho = 6,380 (\text{sec/g ft}) \text{ with air}$

To get results from scale models of a shape
 that will compare proportionally with the same
 shape actual size the Rayonide or of the
 two sections must be kept practically the
 same.

High Lift devices

Slots

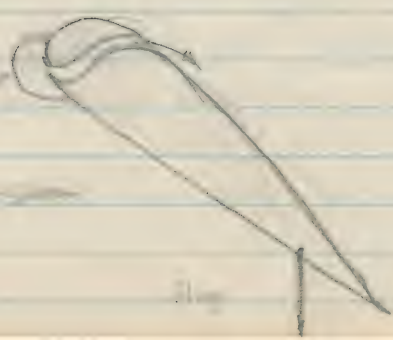


Rayonide

To allow high angled attack
 and therefore slow
 speed.

Also used to
 wing tips to prevent
 wing tip stalling

turbulence
 air

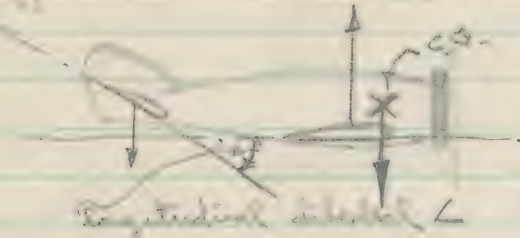


Slot

STABILITY

Can I fly and control the aircraft
and so on. Roll, pitch & yaw etc

Longitudinal Control of Stability (about lateral axis)


 Wings tend to pull
climb aircraft down
and tail assembly
tends to pull tail
down slightly bringing
plane to level attitude in flight.



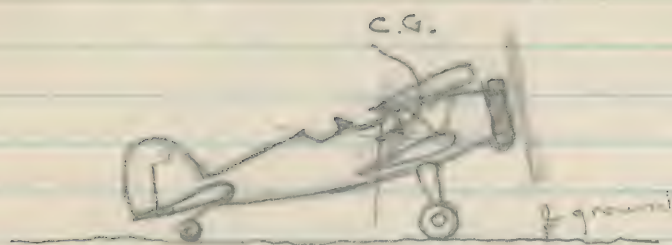
Tail assembly although
appearing to have the same
angle of incidence & attack
with the wing, on the wings is
really operating in the downwash
of the wing and therefore has a much
lower or negative angle of attack.

In a stall the tail no longer gets
this downward pressure hence the
nose drops.

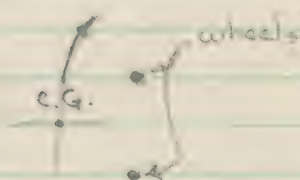
Longitudinal Stability

at low speed, strong recovery attack

Stability



Side
View



Plan
View

any slight movement causes C.G. to come
to the side and this causes it to stop
immediately.

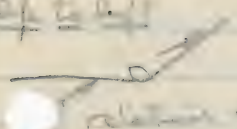
STABILITY CONTINUED

Lateral Stability:-

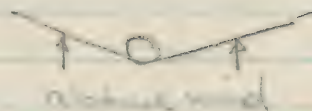
Purpose to keep plane from rolling off
axis.

Dihedral is most device used to insure
lateral stability.

up to left



relative wind



relative wind

up to right



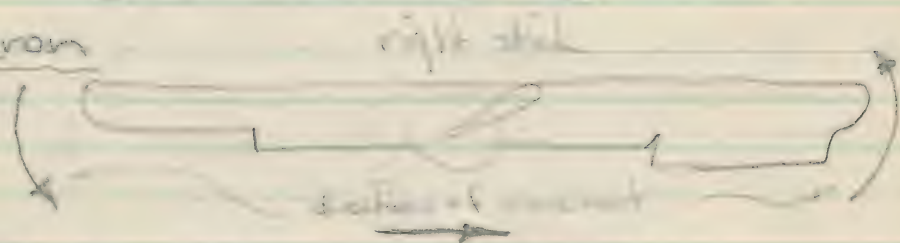
relative wind

Dihedral in wings causes a wing that is
low to have an increased angle of attack and
the high wing to have a decreased angle of attack
resulting in an upward force on the low wing
and a downward force on the high wing.

Aileron Action

However, when a stall, dihedral makes it causes a higher $\angle$ of attack in the low wing caused it to stall more whereas the high wing goes further out at a stall causing plane to rotate more toward stalled or low wing.

Aileron



Negative or Adverse Yaw

Directional Instability - Plane to one place always want to go directly into below wind.

To do this there must be some vertical axis to the rear of C.G. than a fixed Tail fin biggest factor in keeping plane stable.

1. Adverse Yaw Effect of Rudder - rudder must be in line with fuselage to avoid yawing.
2. Adverse Effect of Rudder - tends to lower left wing so only give left wing a little more control. This causes more drag on left side so the tail fin is forced to permanently try to turn engine to the right. This gives good directional stability at cruising speeds. Also the slip stream tends to push the tail to the left thereby tending to return airplane to left.

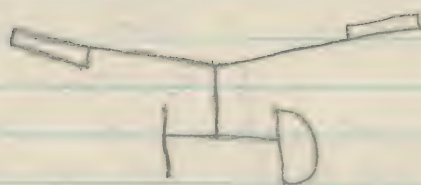
FOOT-PIED AIRPLANE

ENGINE - Small gas engine

Revving speed 100 H.P. 150 P.M.G.

2 propellers

Tail boom
rear



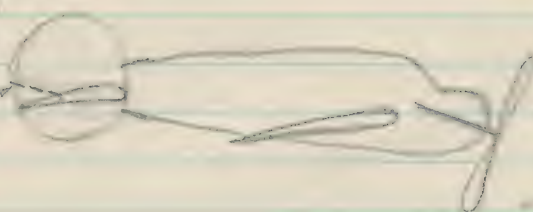
Right
Turn

The rudder, only a wheel, a ball, a handle, works both rudder and ailerons giving perfect coordination and when stuck in either the elevators are not up and down.

Elevators will

not come up

propeller



Propeller is pushed down slightly so that the slip stream of the propeller does not affect the tail rudder by

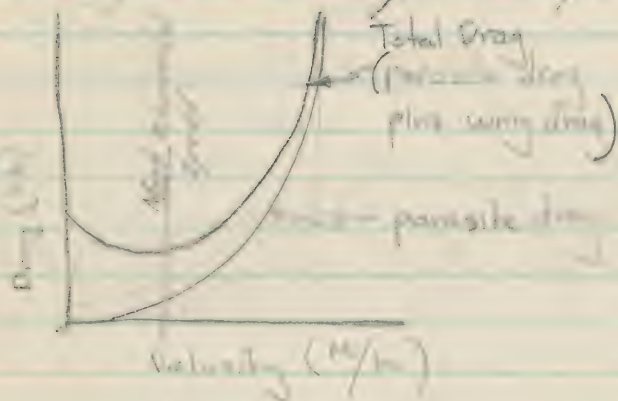
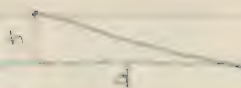
and therefore the only thing that does hit the tail is the down wash of the wings.

TURNS -

PERFORMANCE

GLIDE:-

$$\text{Glide Ratio} = d/h = L/D$$



Parasite drag increases as the square of the velocity



$$W = \text{weight}$$

$$D = \text{Drag}$$

$$L = \text{Lift}$$

$$L = D$$

$$\therefore \frac{L}{D} = \frac{H}{W}$$

$$\therefore \frac{L}{D} = \frac{d}{h}$$

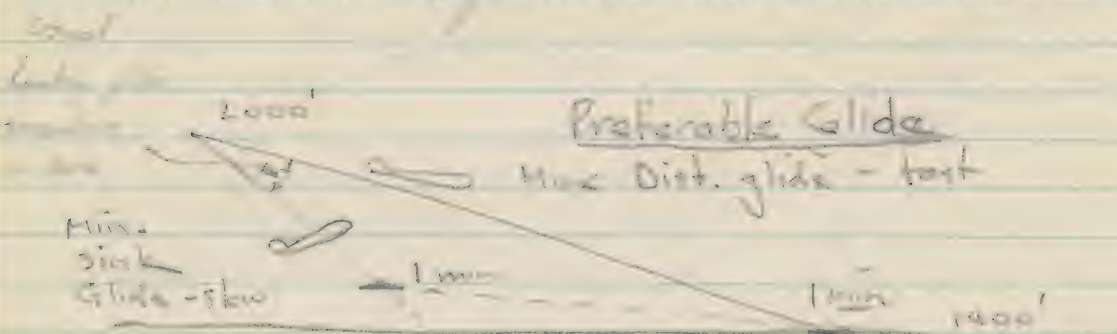
GLIDE:-

The glide that you must know is a best glide.

1. Best glide is fast and out slowly.
2. Against the wind fast and get up further.
3. If there are obstructions before field should spend more money for it to go up over.

To tell whether you are going to clear obstructions in front of a field check to see whether you keep seeing more and more of your side of the field.

Glide Turns which will hold the max altitude should be made as close to a stall as possible and bank at 45° .



A clean airplane will glide safely with the nose higher than in normal flight.

High Dist - or Fast

Glides will be at some angle but slow

Point with fly glide

Climb should be done at the rate that will give the least Drag or L/D because at that point the motor has more power to push it up.

Altitude	18°	16°	11°	-2°
Mph	60	75	110	180
stability	slowest	best L/D	climbing	max
speed	sink	best L/D	speed (fast)	speed
	speed	best L/D if there was no wind		
		extra speed to get plane quicker		

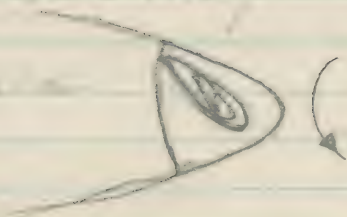
the downward the pressure on the airfoil is increased to keep up the lift available & required.

Properties:

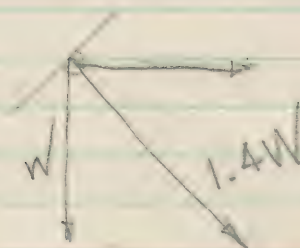
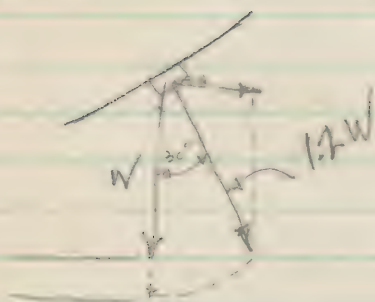
are basically an airfoil
in shape at each.

$(1^\circ - 2^\circ)$

airfoil shape at attack is kept constant from root to tip. Therefore the pitch decreases from root to tip.



Dynamic loads (g loads)



g loads in banks



as g load goes up the stall speed increases because weight is increased

Also structural stress is increased.

LOGARITHMS

POWERS

$$2^5 = 32$$

$$2^4 = 16$$

$$2^3 = 8$$

$$2^2 = 4$$

$$2^1 = 2$$

$$2^{1/2} = \sqrt{2} = 1.414$$

$$2^{1/3} = \sqrt[3]{2} = 1.25$$

$$2^0 = 1$$

$$2^{-1} = 1/2 = .5$$

$$2^{-2} = 1/2^2 = 1/4$$

best part of

2.0

i. Multiplying analog log $8 \times 4 = 32$

adding log of analog

$$3 + 2 = 5 \text{ analog } 5 = 32$$

9990.	=	9 380	$\times 10^3$
999.0	=	"	$\times 10^2$
99.90	=	"	$\times 10^1$
9.990	=	"	$\times 10^0$
-.9990	=	"	$\times 10^{-1}$
-.09990	=	"	$\times 10^{-2}$

log
3.9722
2.9722
1.9722
0.9722
-1.9722
-2.9722

characteristic
mantissa
from log table

Subtraction

Number of digits in number in position of number is greater than unity.

Number of zeros in number in position of number is smaller than unity.

Division

+4

-3

4371.

.0004321

A. Stock extends to right

Subtract number in divisor from number in dividend and then $\times (1)$ digit. This gives number of digits, or zeros in quotient.

B. Stock extends to left.

Subtract as before - this gives number of digits directly.

Multiplication

A. Stock extends to right.

Add number of digits or zero in multiplier and multiplicand and subtract one (1). This gives number of digits or zeros in quotient.

B. Stock extends to left.

Add number of digits, or zero, or dots; this gives number of digits, or zeros directly.

5

13 - 2 = 11. subtract if odd 11 = 12

Example $\frac{142}{12}$

= 57.1

SQUARES

A Number greater than unity.

1. If number falls on left half of A multiply number of digits by two and subtract one. This gives no. of zeros in answer.

2. If number falls on right half of A multiply no. of digits by three.

3 Examples

B. Number less than unity.

1. If number falls on left half of A multiply number of zeros by two and subtract one. This gives no. of zeros in answer.

2. If number falls on right half of A multiply no. of zeros by three and subtract two. This gives no. of zeros in answer.

3 Examples

CUBES

When answer falls in

Right third

Middle third

Left third

Multiply by

3

3 and subtract 1

3 and subtract 2

Section Roots

4. Use Left Half of 4 digits for numbers with an odd number of digits and the right half for numbers having an even number of digits - 11 gives 2.

B. Manual Algorithms:

If number has 3, 4, or 5 gives - root will have 1 or 2 gives.
" " " 0, 1, or 2 " " " no gives.
" " " 1, 2, 3 digits - " " one digit.
" " " 4, 5, 6 digits - " " two digits.

Cube Roots

1. Left Hand Section - Use for numbers having 1 or 4 digits or 2 or 5 gives.

2. Middle Section - 2 or 5 digits, 1 or 4 gives.

3. Right Hand Section - 3 or 6 digits 1 or 3 gives.

METEOROLOGY =

Study of motion of wind direction, of the fact that young winds always blow into old.

Air Mass - a large portion of the earth's atmosphere that approximates horizontal homogeneity.

It assumes characteristics of its source region, the area over which it developed and keeps those characteristics as it moves to other regions until it hits a region that receives very much from its source region. Then changes take place causing marked disturbances.

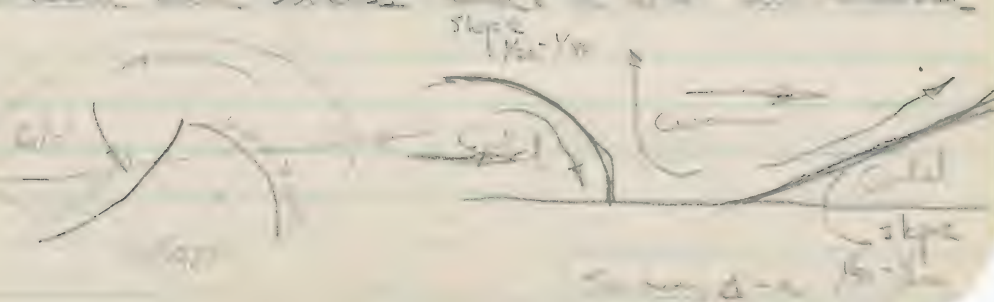
Types - arctic, polar, tropical, equatorial.

Temperatures of masses are always relative either to other masses or to the region each comes from.

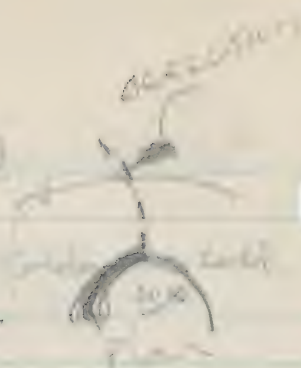
FRONTS

Cold Front - dividing line between an advancing cold air mass and the warm air into which it is advancing.

Warm Front - dividing line between an advancing warm air mass and a cold air mass.



Cold Front Type Occlusion



Warm Front Type Occlusion



Atmospheric Sources of Heat

1. Radiation from sun.
2. Conduction by contact with land & water.
3. Convection currents coming in contact with earth with the radiation and depth heat.

Convection causes convection currents which are vertical currents.

Lapse Rate Wet air 2°F per 1000' ^{dry}
 (temp. dropping) dry air $5\frac{1}{2}^{\circ}$ per 1000'.
 per 1000' 1000' 1000' 1000'

Moisture in Atmosphere always about 4% of moisture on earth.

Relative Humidity - % ratio vapor in air at a given temp compared to water vapor at saturation.

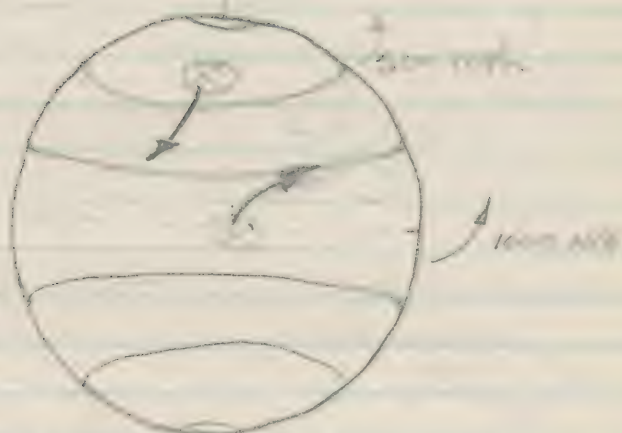
Specific Humidity - Ratio mass of water vapor to mass of air.

Absolute Humidity - Mass of water vapor present in a unit volume of air.

Earth's Deflective Force

If earth did not rotate, the prevailing winds would blow in from the north in the northern hemisphere.

The reason for this is that the earth is rotating from west to east. This causes the air to be deflected to the right in the northern hemisphere and to the left in the southern hemisphere.



As the earth rotates, the air is deflected to the right in the northern hemisphere and to the left in the southern hemisphere.

The result is that the air is deflected to the right in the northern hemisphere and to the left in the southern hemisphere.

Gradient Wind - wind at 90°, where the effect of wind friction and pressure are combined to form a balance.

Geostrophic Wind - wind that blows from pressure gradient force and Coriolis force - usually about 30° or 40° across isobars from high to low.

Winds in high pressure areas turn clockwise
Low pressure areas - counterclockwise

VERTICAL MOTIONS - cause of most land
weather

Adiabatic Process temp. change in an
air particle due to the work done
by expansion of the air as it goes up
or down.

$5\frac{1}{2}^{\circ}\text{F}$ for $1000'$ dry air
 2°F " " " " " " wet air

UNSTABLE AIR - Air that is warmer
than surrounding air and hence rising
more freely.

STABILITY - A particle displaced from
position is subjected to forces which
tend to restore it to its original position.

UNSTABILITY - If in its new position the
particle is subjected to forces which
tend to move it further from its original
position.

NEUTRAL EQUILIBRIUM - In new position the
particle is subjected to no forces either
tending to restore it to its original
position, or displace it further from
its original position.

POTENTIAL TEMP - (always absolute)
 109°F

CUMULONIMBUS, ^{lower} cumulus with cold fronts
primarily - formed by convection

STRATIFORM clouds occur near
warm fronts.

CLOUD FAMILIES

1. Cirrus
2. Alto cumulus and alto stratiform
3. Cumulus
4. Stratiform

(CI) Cirrus - usually cold & warm fronts
very thin and high in position
low level

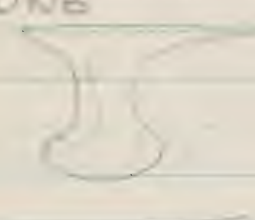
CIST - Cirrus imbricatus, thin
undulating white, thin
usually cold fronts

CICU - (cumulus) small, white, white
cumulus - white - in // bands &
in patches that don't cover
whole sky
usually cold fronts

Alto stratiform - low - cloud at high alt.
solid layer, grey veil, cutting
out almost as in all of sun.

Alto Cumulus - leading edge of cold front
large, lumpy, blackish
clouds with white edges.
high level cloud

Germules - Large fluffy masses of clouds usually found by contrast with cirrus

Cumulonimbus - a cumulus cloud which is
CUNB
 cumulonimbus cloud which
very thick and at the
top sometimes as high as
45,000 ft. or more.
High vertical currents

Clouds in front of a Cold Front

CI
CU
ACU
CO
CUNB
→

AIR MASS CLASSIFICATION

1. Type of Air Mass
2. Source Region
3. Stable or unstable
4. Trajectory
5. Expected weather - (according to trajectory and terrain over which it passed)



Most severe weather occurs with a Polar Continental - Tropical Gulf Front.
Front is very definite, moves rapidly

T.M. 205 Air Navigation

For Times - Dec. 1, Jan. 2 & 3

1. Pilotage - very good, but not perfect.

2. Visual Navigation - some mistakes of time -
 depending on the quality of the
 and terrain.

3. Radio Navigation - Radio beacon ~~not~~
 direction finding
 under discussion.

4. Celestial Navigation

Comparison with other methods.

Very good, but not perfect.

2. In the field of celestial navigation.

Very good, but not perfect.

Very good, but not perfect.

The chart was very good.

Chart was - correct all

information at home for

can be

2. Pilotage - very good - 1 degree =

1/15

1/15

1/15

1/15

1/15

1/15

1/15

1/15

1/15

1/15

1/15



NAVIGATION

Definition: Art of determining the geog. position and maintaining the desired direction of an aircraft relative to the earth's surface by means of:

1. Pilotage — observation of known landmarks
2. Dead reckoning — (D.R.) ground spd, and direction
3. Radio — beacon, direction finder, bearings
4. Celestial Obs. — of celestial bodies to det position

COMPARISON OF AIR & NAVAL NAV.

- | | <u>Air</u> | <u>Sea</u> |
|------------------------------|--|---------------------------------------|
| 1. <u>Currents</u> :- | Varied & changeable
can be strong (90 knots) | constant and steady
slow (9 knots) |
| 2. <u>Visability</u> :- | (5000 ft)
20 to 80 mi | 8 to 10 mi. |
| 3. <u>Compass Accuracy</u> : | Small and subject
to much stress & hence
not very accurate | large &
steady
accurate |
| 4. <u>Celestial Obs.</u> : | Position within 5 to 10 mi | within 1 mi |
| 5. <u>Speed</u> : | 200 ± mi/hr | 0 to 30 knots ± |

MAPS & CHARTS

Definition: a representation of a sphere or a portion of a sphere on a flat surface.

Map — areas that are mostly land

Chart — " " " " " sea

Note

CAA calls all their maps charts.

Projections - methods of representing portions of the earth's surface on a map or chart.

1. Mercator - Grid as projected on circumscribing cylinder.
2. Lambert Conformal - " " " " + cone.
3. Gnomonic ———
4. Polyconic ———

Definitions:

1. Sphere: a body bounded by a surface all points of which are equidistant from a point called the center.
2. Great Circle: a circle on the surface of a sphere whose plane passes thru the center of the sphere.
3. Small Circle: a circle on the surface of a sphere whose plane does not pass thru the center.
4. Rhumb Line: a ~~str~~ line which crosses all meridians at the same angle. (A line on Mercator Projection)
5. Loxodromic Curve: a rhumb line drawn on a sphere.

CHAPTER 5

Painted Conch

Fractional charts $1'' = 8 \text{ mL}$ or $1:500,000$

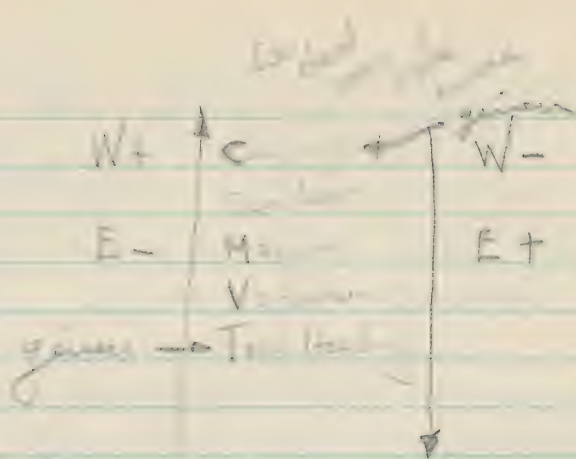
Regional Charts $1'' = 16 \text{ mi} \approx 1:1,000,000$

Wash. Notices To Appear give latest

signature on any checks, etc.

shall always look before coming.

Norman



True course 90°
 Variation $6^\circ W$
 deviation $2^\circ E$
 mag. course 2°
 compass course $= 2^\circ$

REVIEW

1. Change 520 Taut mi to Statute miles
 $\frac{1.15}{578}$

2. Change 1380 SM to NM
 $\frac{1.15}{1380 \text{ SM}}$

3. Plane from A to B 920 mi in 4 hrs
 what is ground speed? $\frac{920}{4} = 230 \text{ Mi/hr.}$

Formulas $\text{Speed} = \frac{\text{dist}}{\text{time}}$ $T = \frac{D}{S}$
 $D = ST$

Units Speed - Mi/hr.
 Time - hrs.
 Dist - Miles

4. Plane GS is 196 knots how many
 statute miles in 3 hrs? Statute - 5 hrs.
 $\frac{196}{3} = 588$ statute miles
 $\frac{196}{5} = 392$ statute miles

5. from 65 165 to 180 by 12.5
15 min. 12.5 at 165 165

G.T. Simpson - 5th class

Review of 13th 4 classes

Plate - known to Smith

Post Casing - Under + over + lines - distinction

Plate has - under square

Cabinet has - under square

Nomenclature

Measures -

Latitudes -

2 variations goes thru Greenwich
Long

Longitude } measured in 15

Latitude } or angular distance
along great circles

1' of arc ^{Lat.} = 1 naut. mile

Rather lines - traverse at measurement point
at line on a meridian project

Comparison

Variation - from by North at long 100° East

Deviation - magnetic interference

by plane itself

Isogonic Lines - lines of equal variation
agonic line - line of zero variation

Statute mile - 5280 ft = $\frac{1}{1.15}$
Nautical mile = 6080 ft = $\frac{1}{1.15}$

Dist = Rate $\times$ Time

Tomorrow Flight 

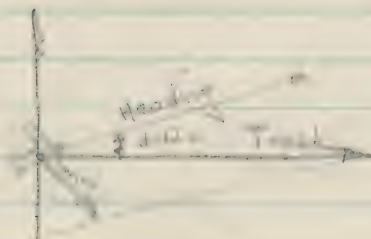
6th Lesson:-

AIR SPEED: True speed of an aircraft relative to the air.

An speed indicator, because of change in air density & temp. is not always accurate.

GROUND SPEED: Actual speed relative to the earth's surface.

DRIFT - The angle between the heading and the track.



DRIFT CORRECTION: The Angle added to or subtracted from air course to true course to obtain heading.
Right drift - subtract $\angle$ in calculation.
Left drift - add $\angle$ to air course.

COURSE - Direction over the surface of the earth expressed as an $\angle$ with respect to true north that an aircraft is intended to be flown.
(Map course)

MAGNETIC COURSE - True Course with
variation applied.

COMPASS COURSE - Magnetic course with
deviation applied.

COURSE MADE GOOD - The resultant true
direction the aircraft bears from
the point of departure. (Dwyer & Young)

TRACK - Actual path of an aircraft over
the surface of the earth. (Dwyer & Young)

HEADING - Angular direction of the
longitudinal axis of the aircraft
with respect to true north.

MAGNETIC HEADING - Heading with
variation applied.

COMPASS HEADING - Magnetic heading
with deviation applied.

WIND DIRECTION & FORCE - Always
taken as the direction from
which the wind blows and
the force always in
mi/hr or knots.

VELOCITY - The rate of change of
position in a given direction.

VECTOR - a mathematical line with

- { 1. direction —
- { 2. magnitude — indicated by length & scale.
- { 3. sense — indicated by arrow pointing in the direction of the vector.

T.N.

Example

course 90°

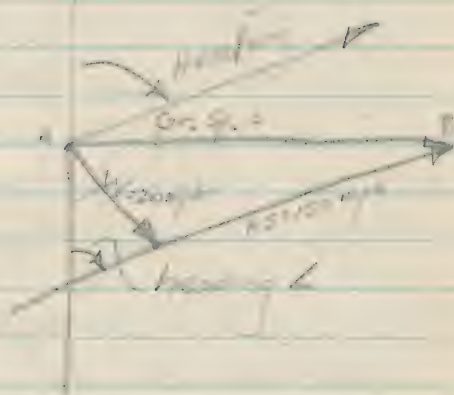
wind 30 mph from 15°

Air speed 100 mph

Find Cr. Spd

Heading

IL



7th Lesson

FEDERAL AIDS TO NAVIGATION

1. Radio range beacons - (Dashed line)

$+ 270^\circ 90^\circ +$ (way bearing)

2. Radio marker beacons - beacons

3000 - 4000 cycles per second - low frequency - give the pilot a warning

★ 3. Rotating beacons (15 mi apart)

to have oblique main pattern between fields

✱ 4. Intermediate landing fields - 50 mi.

oblique main pattern - light - 1000 - 1500 cycles per second

5. Radio communication stations (weather)

6. Weather reporting service (teletype)

7. Airway traffic control - telephone

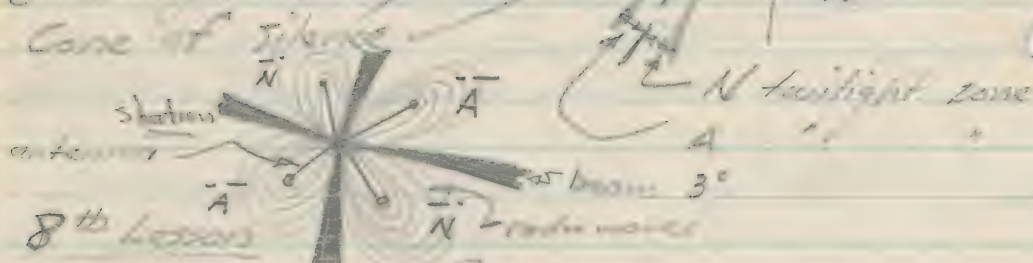
1. N. prominent in prechant. ~~is~~
Not the case, or if the separation there
is due to them the N. prominent is NW.

2. Every 30 seconds the call letters
are given and the gradient
disagreement given continuously.

3° zone or overlap
called the beam.

Planes! keep to
the right communion
in and going out.
(no further zone)

Cone of Silence

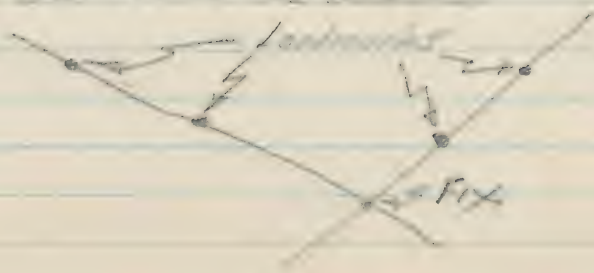


8th

* STEERING & LAUNCH

Pilot lines up 2 good marks and
flies between them, continuing 3 or
2 points to fly between or use to
establish a base line.

FIX Intersection of two lines & find
line being determined by a point & a
vector the line is found



INSTRUMENTS

I. AIR SPEED INDICATOR

Being A. indicated air speed - shown on the speedometer.

B. Calibrated air speed - shown on meter after corrections have been made for errors.

2% of speed added for every 1000 ft. of altitude to make up for decrease in air density at high alt.

SPECIFIC USES OF AIR SPEED INDICATOR

1. To aid in estimating the actual ground speed.

2. To determine best throttle setting.

3. To determine the best glide and climb angles.

4. To determine ~~the~~ whether the chosen speed is safe.

II. ALTIMETER - Not considered accurate for landings under 75'.

Simple Aneroid Barometer.

ZERO SETTING SYSTEM - altimeter is adjusted to read zero when the plane lands ~~at~~ on a particular field.

ALTIMETER SETTING SYSTEM - altimeter set to read true elevation above sea level.

Pressure Alt. - Alt on the standard atmosphere corresponding to the existing barometric pressure.

TURN AND BANK INDICATOR



2 minutes is considered the normal time for a 360°

gyroscopic bank indicator - measures rate of turn.

Don't forget turn keep ball in center position.

Precession of Gyroscopic center axis of axis is pushed in rotated in any direction it will move 90° with ^{force} direction in which it is pushed.

Air Thermometer - gives Temp of air
Clock - 8 days 100 Cent.

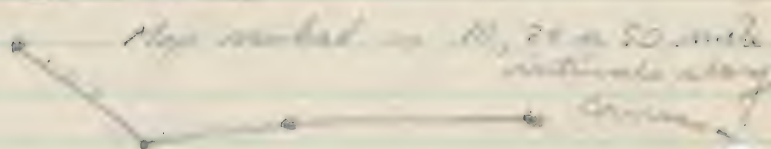
MAPS

SECTIONAL MAPS - show radio stations and directional beams. (Bulky) and call letters.

STRIP MAPS - strip of a large map which show point of origin to destinations. (Convenient and not so bulky)

BEFORE TAKE OFF

ROUTE or COURSE -



1. Get Clearance
2. Check Radio
3. He will have the course and altitude and a speed to fly.

Log Book (T.P. 1-205 Pg 113)

Check Points	Distance From Start	Prop'd ETA	Actual T.A.	Remarks
Start	0	Take off +		
Pt A	12	5 +		
B	21	9		
C	38	15 L		
D	61	26 +		
E	88 -			
F	125			

Clear flight & stay away from

1. Mountain peaks
2. Large bodies of water.
3. Clouds.

When starting pilot circles field until he assigned altitude is then when immediately over field starts timing his flight.

Checks continuously along course,

1. Compass heading.
2. Time and distance flown.
3. Position (by means of check pts)

Pilot's Handbook

1. Radio facility chart
2. Radio data card aids to saving time
- 3.

Lesson 11

Radius of Action: P/A

The distance on a course that a plane will be able to fly and still be able to return to the starting point.

GS₁ = Ground speed out

GS₂ = " " " back

T = fuel hours = 2.5%

$$R/A = \frac{GS_1 \times GS_2 \times T}{GS_1 + GS_2}$$



Interception - 1. Visible
2. Invisible

Contacting an enemy aircraft in the best possible time

The relative bearing must remain a constant to intercept in best possible time

1. Visible ~

B. enemy ship

C

Keep
enemy ship

always in same
relative direction from your
plane.

A

PROJECTIONS:-

MERCATOR: Projection of earth surface onto a cylinder tangent to the earth at the equator.

1. The meridians ^{are vertical lines} are parallel, equidistant at lines
2. The parallels of latitude are not equidistant, parallel straight lines at right angles to the meridians

1. *Longitude*
2. *Latitude*
3. *Scale*
4. *Projection*

DESEABLE ELEMENTS IN A MAP

1. Known line bearing line
2. True Circle bearing line
3. Constant scale in all directions
4. Position to be easily plotted
5. Different areas on earth surface to be in proportion
6. True angles to be maintained

Mercator Adv.

1. Rhumb line plots are a straight line
2. Lat and long quickly found
3. Course line may be directly plotted or can be carried by Hand from *log* ^{to any scale}
4. All charts drawn to same scale will fit
5. Areas within a small lat range are represented by true shape

Meridian Diagrams

1. Distortion especially above 60° .
2. Scale not constant.
3. Great circle is not a st. line.

CONIC PROJECTION (Great Circle Chart)

True perspective projection upon a tangent plane.

1. Meridians are converging st. lines.
2. Great circles are st. lines.
3. Small circles are curved lines.
4. Scale constant.
5. Good for plotting points and determining course.

Not used very much

POLYCONIC PROJECTION

Instrument and required data

LAMBERT CONFORMAL (conic projection)

- A conformal projection of a globe upon a slightly deformed cone which acts as sphere at two parallels called the standard parallels (5° & 45°)
1. Meridians are at converging lines
 2. $1/2$ lat are concentric circles
 3. $1/2$ of $1/3$ is boxed cone
 4. Conformal scale
 5. It has approximate a great circle

Instruments:-

Aperiodic or Air Corp type D Compass

1. A precision instrument that is steady but not sluggish since radial arms or vanes are attached to the compass card to prevent swinging of the compass.
2. Read the compass only when its plane is in level flight and the needle is at rest.
3. To avoid parallax the eye must be directly above the face.
4. Has a rotating outermost ring double bubble line.

Temperature, Pressure & density relationship.
Standard Conditions considered to be

29.92 inches of mercury

$+15^{\circ} \text{ C} = 59^{\circ} \text{ F}$

2° C per 1000 ft lapse rate

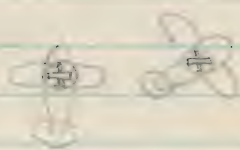
Temp/Lapse Rate = rate at which temperature decreases as one goes $\uparrow$ up.

Atmospheric pressure or density of the air decreases by $\frac{1}{2}$ in every 18,000 feet $\uparrow$ above sea level.

Sensitive Altimeter :- sensitive aneroid barometer

Air Speed Meter - Pitot Tube

DIRECTIONAL GYROSCOPE -
OR TURN INDICATOR



1. Measures amount of turn

behaves like a compass.

2. Is not affected by banking or acceleration as is magnetic compass.

3. However cannot be used instead of magnetic compass as it has to be set from magnetic compass and checked occasionally.

Drift Meter

$$GS = \frac{H \times (\tan \Theta - \tan \phi) \times k}{t}$$

H = absolute altitude (ft)

t = time in sec.

ϕ = angle back of vertical that timing is started

Θ = angle at which timing was stopped

k = a constant whose value depends on whether the ground speed is measured in knots or statute miles.

GS = ground speed.



ALIGNMENT COMPENSATION AND CALCULATION OF INSTRUMENTS

DRIFT METER

1. Drift wires must be // to the longitudinal axis of the plane when pointer on the azimuth scale reads 0 or 180°. Aligning the Drift Wires

2. ZEROING THE TRAIL ANGLE

With the trail angle set to zero the line of sight must be vertical when the airplane is in flying position.

Potometer instrument must align
with the drift meter. Inst. used
to make actual ~~from~~ observations.

COMPASS

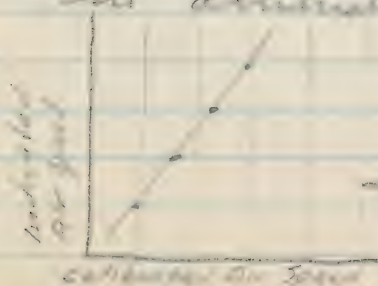
1. ALIGNMENT - Rubber line must
be laid over longitudinal axis
of the plane.
2. COMPENSATION - Correct for
~~deviation~~ deviation.
Deviation corrected as much
as possible and attempt made
to make variation in elevation
a minimum for cardinal points.
3. FAINING - Determine cardinal
points and so accurate so that
a graph is made to show deviation correction.

CALIBRATE AIR SPEED METER

Take readings both with wind
and with wind and make adjustment
to make indicated air speed as nearly
right as possible.

Indicated air speed - speed indicated
by instrument.

Calibrated air speed - Indicated
air speed corrected for changes
in altitude and temperature.



I.A.S.	110	125	165	220
C.A.S.	115	132	173	250

Graph

Wind Angle - $\angle$ between the true
course of the aircraft and the wind
direction measured right or left
to the direction from which the wind
blows. This never over 180° .

Wind angle and direction - which
course - ground speed of 95.
Heading - direction of air craft

Halfpale at Slieve Donard

1. Diagram

2. Computer

3. Table

DOUBLE DRIFF

True	Wind	Drift angle
on course heading 60°	True off course	
A.S. 130 knots	15° E of course	
@ 25° 15%	first that drift $\angle$	
@ 45° 3%	is 15° less 40°	
	$\angle$ Left what is the	
Point	course at the left of	
small deviation & velocity	course and that	
Ground speed	and the left box	
	4 5° E.	



Given

wind 20 knots 315°

heading 165°

AS 200 knots

Find Track

Ground Speed



BEARING - Direction of one object from another expressed as an angle measured clockwise from true north.

MAGNETIC BEARING - True bearing with the variation applied.

COMPOUND BEARING - Magnetic bearing with deviation applied.

RELATIVE BEARING - is the direction of an object expressed as an angle measured clockwise from the true heading of an aircraft.

REVERSED BEARING - (REVERSE BEARING) - bearing plus or minus 180° .



For Mounting Camera & Photogrammeter

1. Check all instruments such as

camera, photogrammeter, system
altitude setting

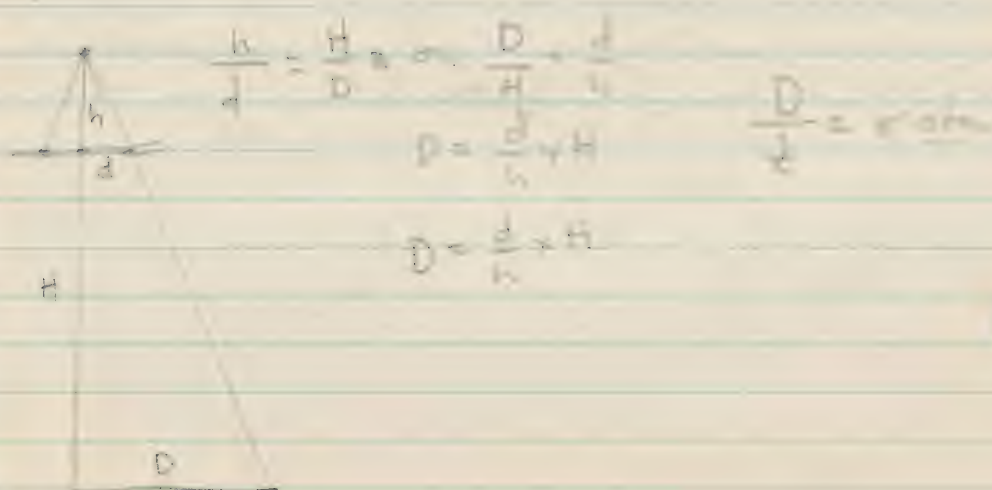
Reliability of navigation system team
"double check" any change in
altitude bearing for altitude or
air speed.

NAVIGATORS LOG BOOK

detailed record of trip showing
course planning, check points, time at
points of light.

DRIFT METHOD for Ground Speed

Zero L Method - by knowing
altitude and getting D time that
it takes for one point on ground
to pass from one X line in drift meter
to other.



Eggs, Rabbits

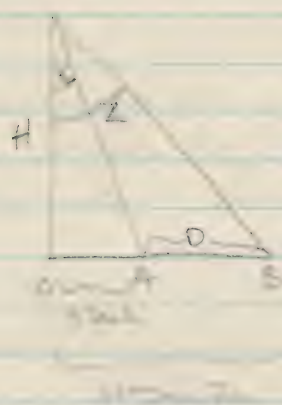
$$3.3' = 1 \text{ knot}$$

$$1 \text{ knot} = 101.3 \text{ ft/min} = 1.69 \text{ ft/sec}$$

$$1 \text{ knot} = 1.69 \text{ ft/sec}$$

$$\frac{1}{1.69} = .592 \text{ or } 59.2 \text{ sec per ft}$$

TRAIL L METHOD



$$\tan 1 = \frac{OA}{H}$$

$$H \tan 1 = OA$$

$$\tan 2 = \frac{OB}{H}$$

$$H \tan 2 = OB$$

$$H \tan 2 - H \tan 1 = D$$

$$GS = \frac{H(\tan 2 - \tan 1)}{t}$$

in (ft/min)

Loggins - determine field measure

Time = 24 hours

Time of day is recorded to nearest 1/4 minute

Depth and GS can be determined with note by dropping a plane

Loggins should be done regularly but the in field night.

Conceal
Conceal
Revelation

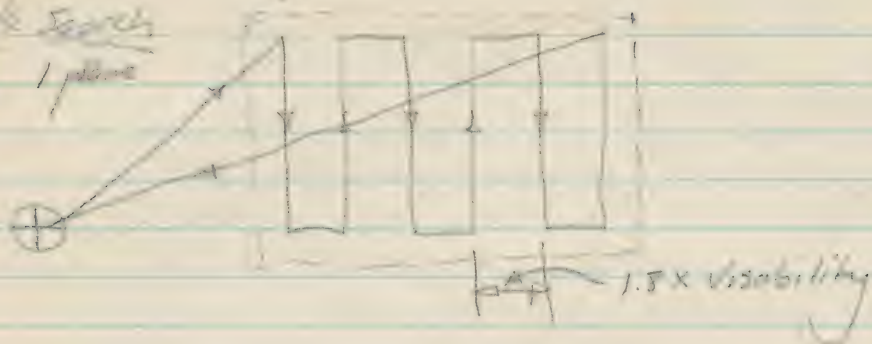
Definición

Search Mission: is a reconnaissance flight executed for the purpose of locating survivors from a crash or aircraft to the sea.

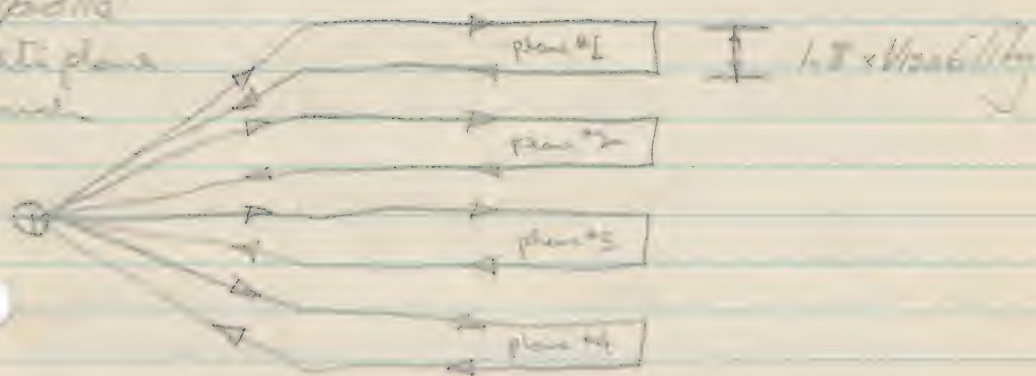
Patrol Mission is a flight executed for the purpose of maintaining continuous observation of a line to detect the approach or passage of enemy sea forces.

TRAVERSE FLYING - A traverse is the irregular track of an aircraft when it has flown several different straight line courses in succession.

Parallel Returning to same base
single search
1 plane



Parallel
multi plane
search



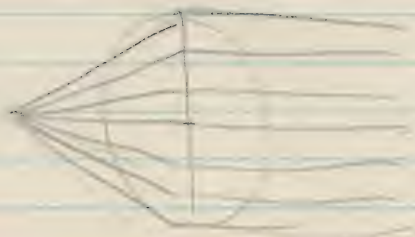
Parallel search returning to same base

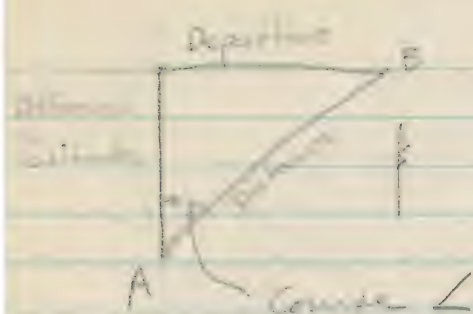


Radial



Radial & Parallel



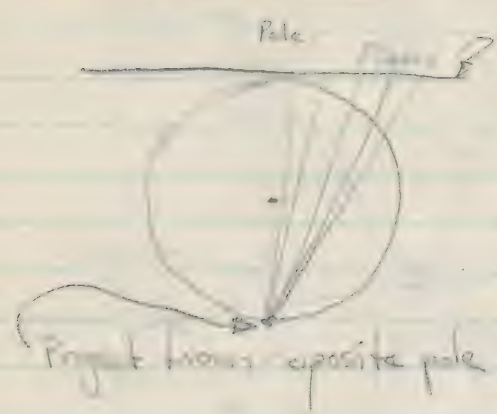


Instructions to Compass

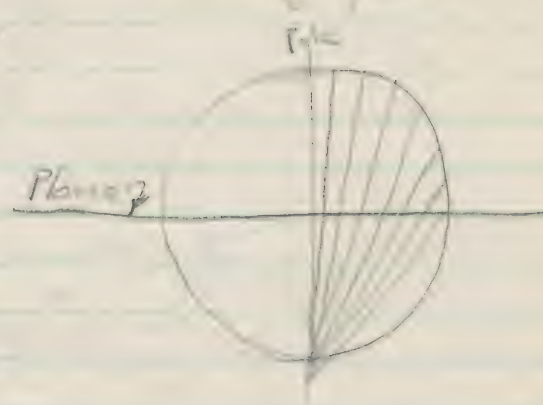
1. Plane put on turn table, tail wind, and ~~tail wind~~ running.
2. True direction, being known on the table, the plane is swung around table.
3. compensating magnets adjusted to give as near the same deviation as possible in all elevations.
4. Plot run with notes on a strip and results recorded.

PROJECTIONS

Plane Polar



Stereographic

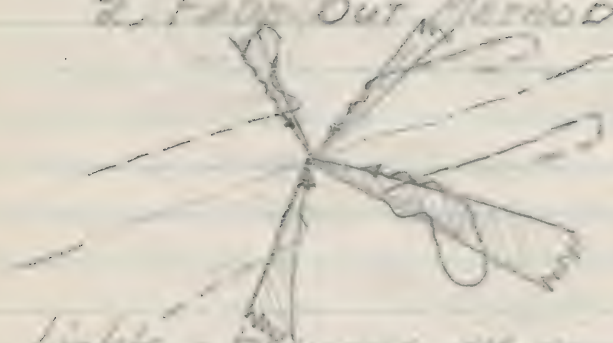


RADAR RANGE

Orientation on a beam
1. 90° method



2. Fade Out Method



Lights - Beacons are numbered W to E
N to S

1. only one not flashed therefore some
will be flashed every 10 lights
2. light flashed @ 6 flashes/min
- 3.

AVIATION RULES - FRONT RULES

1. Observe local field traffic rules (CAA approved)
2. Take-offs shall not be commenced until there is no risk of collisions.
3. Give airports to left unless given other instructions.
4. Maintain a st. approach before crossing the airport boundary for 1000 ft.
5. Above 3000 or more than 3 miles away from airport need not circle left.
6. Arriving or departing traffic takes precedence over local traffic within control area.
7. When panel O or X is displayed field is open or closed.
8. Over high expressive or danger areas maintain alt. sufficient to make an emergency landing outside of area. In no case fly less than 1000' over area.
9. Order of st. of way.
 1. Free balloons
 2. Gliders
 3. Dirigible
 4. Airplane
10. When two aircraft cross common one on left has st of way.

11. Aircraft approaching harbor shall both alter course to rt. to pass at least 500' apart.
12. Overtaking aircraft shall keep clear of overtaken aircraft by passing to overtaken right.
13. Landing aircraft in 1000' approach have it of way except over aircraft landing in distress.
14. Aircraft in distress has it of way in landing.
15. When maneuvering for landing airplane at lower alt. has it of way.
16. Keep to rt of radio range beam.
17. Minimum Safe Alts.
 - 1000' - Congested areas (high bldg.)
 - 1000' - High explosive area
 - 1000' - Over dry federal periphery
 - 1000' - 11 ft. open assembly
18. Contact Flight rules
 1. 500' above water or ground.
 2. 500' from any man-made or other obstruction.
 3. 300' above open water during daylight for amphibious or seaplanes.
 4. Instrument flying minimums at 1000' above highest pt.
 5. Altitudes less than these are prohibited except for training flights & test flights.

CONTACT FLYING

1. Ceiling - 1000'
2. Visibility at flight altitude over 1000' must be at least 3 miles
3. Visibility at or below 1000' outside of control zone
Night - 2 miles, Day - 1 mile
4. Visibility within control zone
3 miles day or night - 1000'
5. Overcast - 500' below
day or night 500' above ground
2 mi. visibility
6. 2000' horizontally away from clouds
7. Flight to be made if
to be in control zone
8. Flight
- 9.

INSTRUMENT RULES

1. For instrument lands or take
off unless provided by tower
A. 500' ceiling, 1 mi. visibility
2. Have suff. fuel for flight scheduled
plus 45 minutes cruising -
3. Flight plan must be approved
prior to entering control area
4. Communicate arrival or departure
time, altitude and course prior
to entry or takeoff

5. upon completion of flight file
arrival message, if flight plan
has

6. alternate airports with radio range
must have following minimum
requirements

Overcast
Ceiling 2000 ft visibility 3 mi

Broken Clouds
Ceiling 1500 ft visibility 3 mi

7. alt. airport with no radio range,
sta in operation must have
unlimited ceiling and 3 mi
visibility

8. comply to next rules if you
cannot see ground at alt. 1000
9. if

Acron always at angle of 45° or more

Acrobatics

1. None over congested areas or
within 1000

2. No acrobatics less than 1500' -
when ceiling is less than 3000'
visibility less than 3 miles -

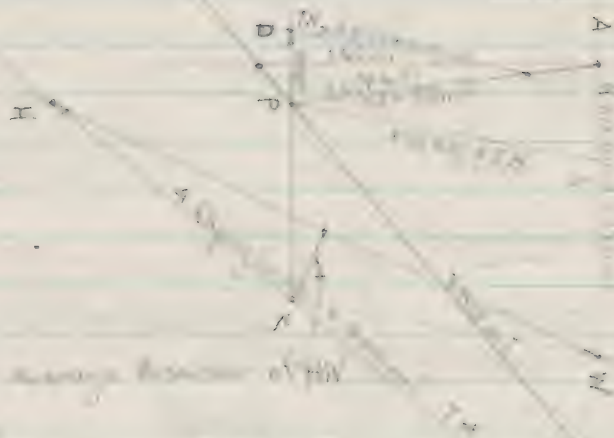
CRASH COURSE

1. Draw line between two points
2. Scale off as much as 20 miles
3. Make out log with a check point every 20± miles
4. Take along 1 small test kit, Flares, 2 lit up
 2. Radio battery, flashlight
 3. Maps, compass, pencil
5. Climb to Mt. pass over airport and note time and azimuth.
6. Check on check points, if off change bearing approx. 10 for every 50 miles.

Test Log, p. 63 thru 121.

---	- W	- When
---	- U	- Undertaking
---	- V	- Very
---	- H	- Haul
---	- R	- Routes
---	- K	- Keep
---	- D	- Direction
---	- B	- By
---	- G	- Good
---	- M	- Methods

Flying from O to D - alternate
airport $\Delta t^0 A$ TC = 230° OD = 350 mi
wind 40° @ 30 mph, 100 mph = AS
4 hours of fuel + 257 mins



$PA = 125 \text{ g} \times 90\% = 112.5 \text{ g}$

Cross Country

1. Draw line between waypoints
2. 5 mile off our mark every 20 miles
3. Make out log with a check point every 20 miles
4. Take along / small test kit, Flares, Shovel
 2. Radio battery, fuel, etc.
 3. Maps, compass, pictures
5. Climb to alt. pass over airport and note time and azimuth.
6. Check on check points, if off change heading approx. 10 for every 50 miles.

Test Run #3 thru 12/

---	- W	- When
---	- U	- Undertaking
----	- V	- Very
....	- H	- Hard
---	- R	- Routes
---	- K	- Keep
---	- D	- Direction
----	- B	- By
---	- G	- Good
---	- M	- Methods

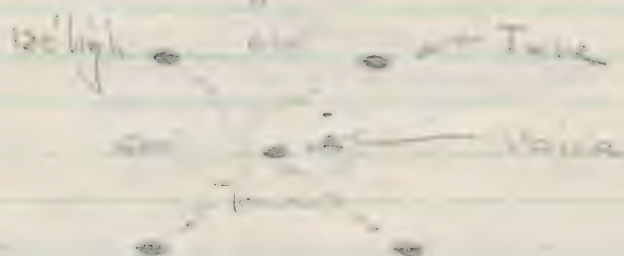
Flying from C to D alternate
airport at A TC = 230° OB = 350 mi
wind 40° @ 20 mph, 100 mph = 45
4 hours of fuel = 15% reserve


$$CF = 3200 - 1200 = 2000 \text{ MW}$$
$$P_k = \{z \in \mathbb{C}^n : |z| \leq 1, \text{ and } z \text{ is a } k\text{-th root of unity}\}$$

Radio Range

Radio Range Station - 2 types

1. Loop Antenna - straight up in playground
2. Colbrook System



With H. beam

50' at station -

7 1/2 mi. wide at 150 mi. from station.

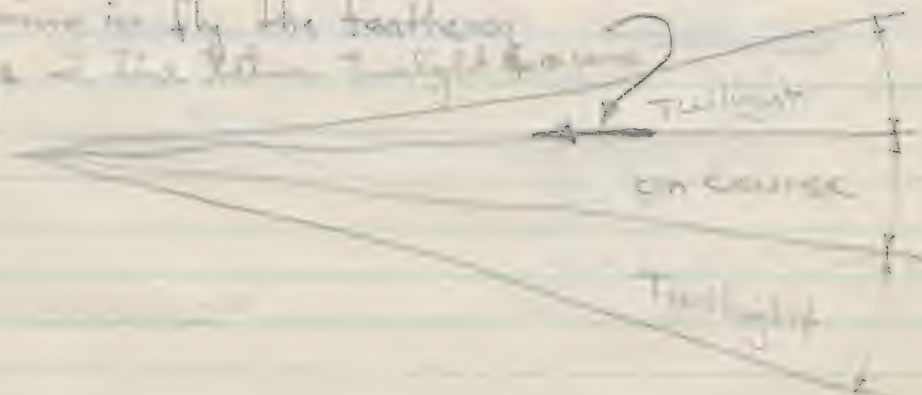
100 mi. considered to be serviceable area.

N. Quadrant 30" - N signal
7" - 150 ft. signal post

On course track line

2 station. signal

Coming in fly the feathered
edge of the line - light beam

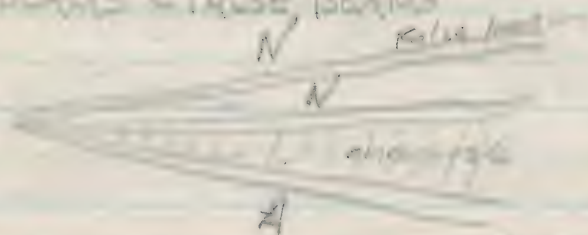


East Area

1000 ft zone

signal from station

SPLIT BEAMS & FALSE BEAMS



Case of Silence

2000 ft up 344 m

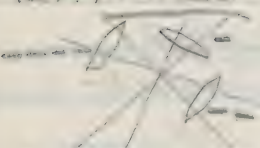
Long signal signal

"2" marker
(Marker Beacon)

75 m. with 3000 cycle note
file along silence with line

Flare Marker

75 m. with 3000 cycle note



Both picked up by the special marker beam
receiver and in BT 13A

"M" marker

3 mi radius

5000

11 ft



was one full of H...
transmitter on both frequency 320 KHz & 256 KHz

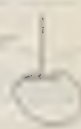
RADIO COMPASS - Antenna of 2
uses: same shape

1. Two types of loop antenna
 one rotating, one fixed
2. also vertical antenna

When loop antenna is turned
 with plane of loop in line with
 transmitter magnetic is highest.

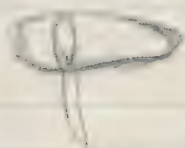
Vertical antenna picks up signal
 with same voltage in all directions.

Power received 150 - 1500 KC

ADDITIONAL Note - min. distance
between antennas 

LEFT RIGHT INDICATOR

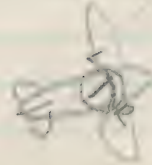
Rotating loop



needle turns
 in direction
 of station
 center



of station



needle turns
 opposite to
 direction of station

Facility Charts - Monthly - US & all foreign
 Weekly Notices by Air Mail - Weekly
 Special " " " " - as required
 Sectional Maps

FACILITY CHART

Ex.

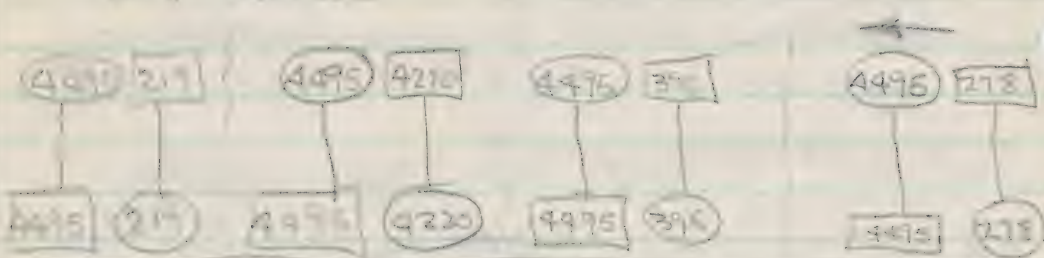
ATLANTA

Bonus - 266 ==

Tax 278 - time to get tax

Traveling Commission

○ to be used
 □ Radio



Greenville

On radio range if frequency is indicated
 in voice transmission is available.

TX

344 ==

CLIMATE

ATMOSPHERE - 3 main elements - 1. Pressure
2. Temperature
3. Humidity

Air - 800 miles thick

2 main zones - 1. Troposphere
2. Stratosphere
divided by Tropopause

1. Highest in summer than winter
2. 18° in equator
3. 0° in poles

TEMPERATURE

1. Air unstable conditions exist here.
2. Greater % of water vapor.
3. Decrease of Temp with alt. 5.3°F/1000 ft dry

STRATOSPHERE

1. Very stable
2. Very much less H₂O vapor
3. No chemical layer - almost constant Temp.

ATMOSPHERIC CONSTITUENTS

I Constants

1. O - Oxygen 21% by Vol.
2. N - Nitrogen 78% " "
3. Rare gases 1%

II Variables

1. Water Vapor - most important
2. Contributions to visibility - dust and etc.

Metereological Elements

I Pressure - Def. Force per unit area.

1. Mercury Barometer - measures air

2. Aneroid Barometer - reads to .001 in.

3. Altimeter "

C. Barographs - recording aneroid barometer
pressure & temperature time

2. Pressure goes down approx $1/30$ every
900 ft. or
(33 mbar) = .01 inch (mercury) = 7.5 ft. alt.

$\frac{1}{2}$ of atmosphere } below 18000' alt.
90% of water vapor }

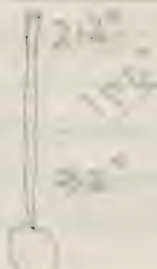
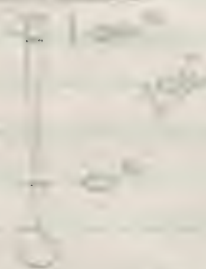
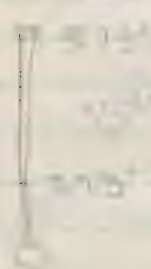
II TEMPERATURE

A. Measurement - by thermometers

Absolute

Celsius

Fahrenheit



$$F = \frac{9}{5} C + 32$$

$$C = \frac{5}{9} (F - 32)$$

Normal Trans. point down to $-37^{\circ} C$

Altimeter " " below $-20^{\circ} C$

Bimetal Thermometers - used for
Thermographs

3 Methods of Heat Transfer

- ② → 1. Radiation (propagates)
- ① → 2. Convection - transfer of heat by
transferring the thing that transports it
3. Conduction

Heat 30/10/1962

1 Heat of Vaporization (expensive)
and condensation

2. Conduction - most important

Radiation - Sun 6000°C shortwave (mostly
infrared)
Earth 20°C long wave (mostly
infrared)

Water vapor can only absorb
long wave length R. It does
not absorb short wave but does
absorb the long reflected rays.

The reason the sky is blue is that
short waves are deflected more readily
than long waves - short waves
are blue therefore sky is blue.

III How to

A. Relative Humidity - Ratio of
actual water vapor pressure to sat.
vapor pressure at same Temp & press.
Rel H. = actual / possible

B. Absolute Humidity = $\frac{\text{Wt. of H}_2\text{O vapor}}{\text{Total volume of air}}$

C. Specific Humidity = $\frac{\text{Wt. H}_2\text{O vapor}}{\text{Wt. of entire mix}}$

D. Mixing Ratio = $\frac{\text{Wt. H}_2\text{O vapor}}{\text{Wt. of dry air}}$

Mixing Ratio always less than S.H.

Dew Point - water relative humidity
reaches 100%

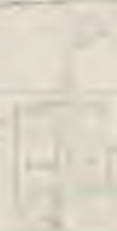
Measuring Rel. Humidity - Hygrometer

1. Hair or Foil Psychrometer
Hydrograph

2. Use psychrometer

Measure of amt of
evaporation

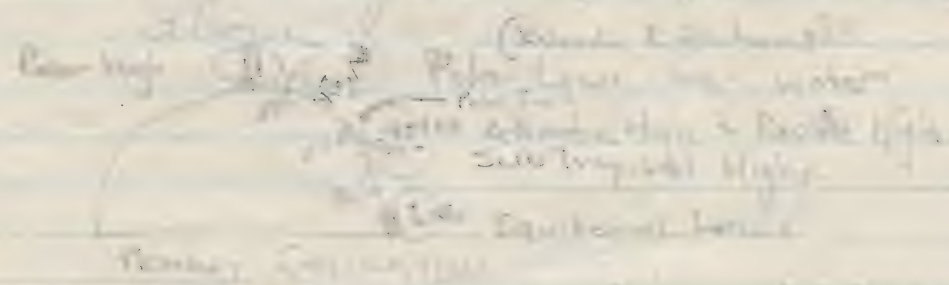
Dow Lake



5000 ft. - 10° cools the night
surface to 10° and on
an open surface often
with the wind the
surface the temperature is higher
than the air.

General Characteristics

1. General to medium heating of surface which shows moderate winds on surface and moderate winds above.
2. Surface wind - surface wind is weak - 0' at surface and more at pole.
3. Surface wind - 10' at surface and 50' at surface.



Subsiding High has light winds about 65 mph.

Factors Governing

wind shifts. The wind is to the left with the wind. As you go up the wind shifts.

Secondary Circle (Liquor)

for 9.0 min

High - Chlorine water (Amalgam)
Low - Concentration " (Sodium)

Reading the time scale is only for
the purpose of gradient. High & low

Centrifuge force

and Coriolis force

But the time of separation is also

Q112

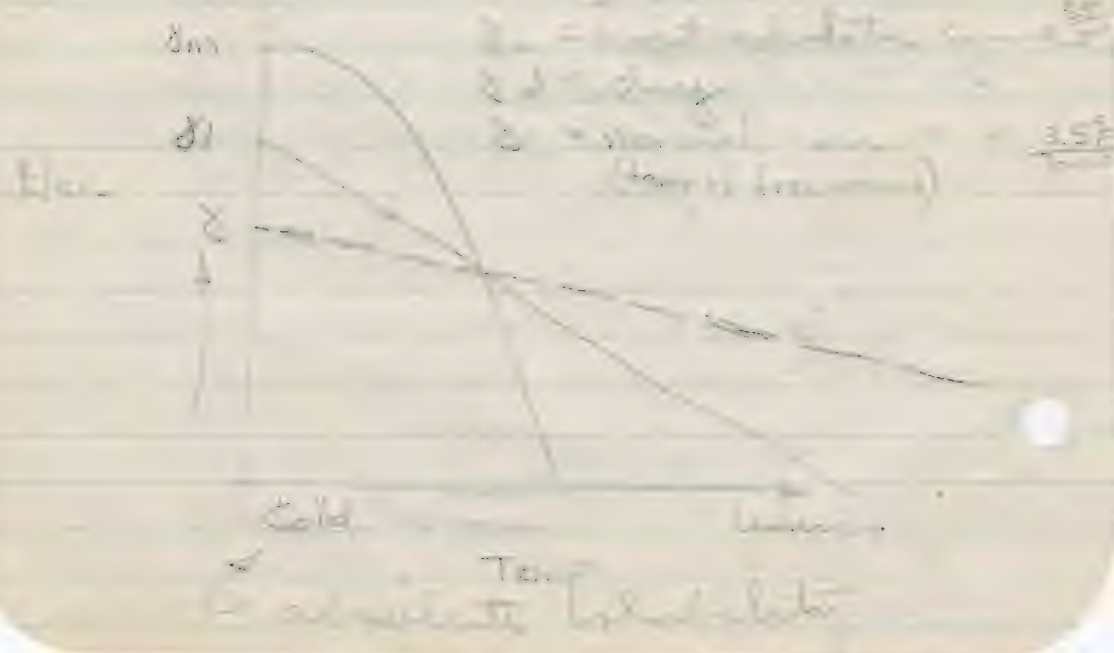
Isobars - 1. stable - not very

2. unstable - by gravity

3. unstable - not very

Hydrostatic - 4. stable

Ed = Dry Air - 53°F per 1000'



Climate stability - when a
region is consistently both for

14.11 $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$ (proper rule)

Conditional stability is a factor
but is rather low. Am. & unstable

for δd
 $\square$ $\delta d > 1 > \delta m$

Vertical stability is better a lower
line of sight with the hands of
vertical and 2m or 3d

$$\text{definite } [1/5] \quad 8 = 8_{\text{in}} \text{ or } 8_{\text{el}}$$

Uitdrukken $[5] = 8d > f > f_m$

Exemple (15) - $\delta d < \delta < \delta m$



Square
Thermometer

Unstable in - temperature, weather

1. ...
2. ...
3. ...
4. ...
5. ...
6. ...

Stable in - ...

... ..

Fairly stable hill ...

1. ...
2. ...
3. ...

... ..

1. ...
2. ...

Dr. H. H. H. - *polina* & *coll*
stomach *coll* *coll* *coll*
longer.

5. *coll* *coll* - *coll* *coll* *coll*
2. *coll* *coll* *coll* *coll* *coll*
3. *coll* *coll* *coll* *coll* *coll*.

Coll *coll*

CP - *CP* - *coll* *coll* *coll* *coll*

NP - *NP* *coll*

CT *coll*

NT *coll* *coll* *coll*

CP *coll* - *coll* *coll* *coll* *coll* *coll*

CP *coll* is *coll* *coll*
more stable because *coll*
is *coll* *coll* *coll* *coll* *coll*
it is *coll* *coll* *coll* *coll* *coll*

CP *coll* is *coll* *coll*
more *coll* *coll* *coll* *coll* *coll*
coll *coll* *coll* *coll* *coll*
2. *coll* *coll* *coll* *coll*

CP - *coll* *coll* *coll* *coll* *coll*
coll *coll* *coll* *coll* *coll*
2. *coll* *coll* *coll* *coll* *coll*
2. *coll* *coll* *coll* *coll* *coll*
coll *coll* *coll* *coll* *coll*

5. Green more upstate
 it was in the valley,
 about 2000 ft. but
 then the river was
 a few miles up, and the
 6 ft. of the river was
 a few miles up the river
 a few miles up the river

7. The river was about 1000 ft.
 and the river was about 1000 ft.
 is the river and the river

Page 1000 ft.

1. The river was about 1000 ft.
2. The river was about 1000 ft.
3. The river was about 1000 ft.
4. The river was about 1000 ft.
5. The river was about 1000 ft.

- 2
- 3
- 4
- 5
- 6

1. The river was about 1000 ft.
 2. The river was about 1000 ft.

6. Summer - 1. Cold & dry (Feb. 2. 1911)
2. No snow but frost
3. Snow in March

(Cattle Grazing)

1. Cattle Grazing - 1/2 of the year

1. Cattle Grazing - 1/2 of the year
2. Cattle Grazing - 1/2 of the year
3. Cattle Grazing - 1/2 of the year
4. Cattle Grazing - 1/2 of the year

5. Cattle Grazing - 1/2 of the year

6. Cattle Grazing - 1/2 of the year

1. Cattle Grazing - 1/2 of the year
2. Cattle Grazing - 1/2 of the year
3. Cattle Grazing - 1/2 of the year
4. Cattle Grazing - 1/2 of the year

7. Cattle Grazing - 1/2 of the year

8. Cattle Grazing - 1/2 of the year
and more water than the high quality
study can, for the study of
the study.

9. Cattle Grazing - 1/2 of the year
and more water than the high quality
study can, for the study of
the study.

Vol. 200 2000 2000 2000 2000
2000 2000 2000 2000 2000

2000 2000 2000 2000 2000

Foot 11 - horizontal gone between
the two sections.

Dist. 1000 ft by

1. Island shift
2. clear point
3. Trench
4. Roubidoux Channel - rocky - present foot
5. Cloud Bank - rocky - present foot
6. ~~Cloud Bank~~ - rocky - present foot
7. Roubidoux Channel - rocky - present foot

Gravelly River to the

Gravelly River 1/2 - 1/2

Wash. River 1/2 - 1/2

Station 1000 3-5

on the river in the
the river - gravelly

FRONTAL 1100000 ft

1. 1000 - 1000
2. 1000 - 1000

alt. 1000

Passerine, 2 or 3 seen along
stream. (S. 1000 ft. alt.)
One or more seen flying
over the valley. (alt. 1000 ft.)

Two or three seen near the
stream. (alt. 1000 ft.)
One or more seen near the
stream. (alt. 1000 ft.)

One or more seen near the
stream. (alt. 1000 ft.)

Two or three seen near the
stream. (alt. 1000 ft.)

One or more seen near the
stream. (alt. 1000 ft.)

Case H. 1 } 3.5-4
 1000 ft. Day 9.9
 1000 ft. 1000 ft.
 1000 ft.

On more good some narrow
 and is located in stable & narrow

part with some small part
 clouds and some small part
 in front
 clouds high middle & low
 off the alt.
 1000 ft. - 1000 ft.
 1000 ft. - 1000 ft.
 1000 ft. - 1000 ft.

TERRAIN EFFECTS

1. DIRECTION HEAT 10

A. LESS NO more because
 the temperature is so high
 1000 ft. heat is more and
 constant quantity down to 70 ft
 up to water keep it cool
 down the day

C. I might say the
 temperature is relatively low
 1000 ft. the temperature is
 water is the same

B. LAND - 1000 ft. is radiated
 by the sun but the water is
 not so much. 1000 ft. is

C. Daily shifts on either side
and cloudy weather

D. Seasonal shifts in the
monsoon

Indian monsoon most marked


A due to wind blowing
to the left in summer

E. Transition and Valley Monsoon
Valley Monsoon - Day
Monsoon - Night

F. Chinook or Föhn Wind


Path on the left side of the mountain
to the right side

G. Transition effect on the
seasonal shifts and starting
of wind on the

10/20/16

1. Change in water

72° - 4 - 15 2. same as 1

2. The change in water

3. The change in water

4. The change in water

5. The change in water

6. The change in water

7. The change in water

8. The change in water

9. The change in water

10. The change in water

11. The change in water

12. The change in water

13. The change in water

14. The change in water

15. The change in water

16. The change in water

17. The change in water

18. The change in water

19. The change in water

20. The change in water

21. The change in water

22. The change in water

23. The change in water

24. The change in water

25. The change in water

26. The change in water

27. The change in water

28. The change in water

DEWING

1. 5. 1900

2. 10. 1900

3. 15. 1900

4. 20. 1900

5. 25. 1900

6. 30. 1900

7. 1. 1901

8. 2. 1901

9. 3. 1901

10. 4. 1901

11. 5. 1901

12. 6. 1901

13. 7. 1901

14. 8. 1901

15. 9. 1901

16. 10. 1901

17. 11. 1901

18. 12. 1901

19. 1. 1902

20. 2. 1902

21. 3. 1902

22. 4. 1902

23. 5. 1902

24. 6. 1902

25. 7. 1902

26. 8. 1902

27. 9. 1902

28. 10. 1902

29. 11. 1902

30. 12. 1902

31. 1. 1903

32. 2. 1903

33. 3. 1903

34. 4. 1903

35. 5. 1903

36. 6. 1903

37. 7. 1903

38. 8. 1903

39. 9. 1903

40. 10. 1903

41. 11. 1903

42. 12. 1903

43. 1. 1904

44. 2. 1904

45. 3. 1904

46. 4. 1904

47. 5. 1904

48. 6. 1904

49. 7. 1904

50. 8. 1904

51. 9. 1904

52. 10. 1904

53. 11. 1904

54. 12. 1904

55. 1. 1905

56. 2. 1905

57. 3. 1905

58. 4. 1905

59. 5. 1905

60. 6. 1905

61. 7. 1905

62. 8. 1905

63. 9. 1905

64. 10. 1905

65. 11. 1905

66. 12. 1905

67. 1. 1906

68. 2. 1906

69. 3. 1906

70. 4. 1906

71. 5. 1906

72. 6. 1906

73. 7. 1906

74. 8. 1906

75. 9. 1906

76. 10. 1906

77. 11. 1906

78. 12. 1906

79. 1. 1907

80. 2. 1907

81. 3. 1907

82. 4. 1907

83. 5. 1907

84. 6. 1907

85. 7. 1907

86. 8. 1907

87. 9. 1907

88. 10. 1907

89. 11. 1907

90. 12. 1907

91. 1. 1908

92. 2. 1908

93. 3. 1908

94. 4. 1908

95. 5. 1908

96. 6. 1908

97. 7. 1908

98. 8. 1908

99. 9. 1908

100. 10. 1908

101. 11. 1908

102. 12. 1908

103. 1. 1909

104. 2. 1909

105. 3. 1909

106. 4. 1909

107. 5. 1909

108. 6. 1909

109. 7. 1909

110. 8. 1909

111. 9. 1909

112. 10. 1909

113. 11. 1909

114. 12. 1909

115. 1. 1910

116. 2. 1910

117. 3. 1910

118. 4. 1910

119. 5. 1910

120. 6. 1910

121. 7. 1910

122. 8. 1910

123. 9. 1910

124. 10. 1910

125. 11. 1910

126. 12. 1910

127. 1. 1911

128. 2. 1911

129. 3. 1911

130. 4. 1911

131. 5. 1911

132. 6. 1911

133. 7. 1911

134. 8. 1911

135. 9. 1911

136. 10. 1911

137. 11. 1911

138. 12. 1911

139. 1. 1912

140. 2. 1912

141. 3. 1912

142. 4. 1912

143. 5. 1912

144. 6. 1912

145. 7. 1912

146. 8. 1912

147. 9. 1912

148. 10. 1912

149. 11. 1912

150. 12. 1912

151. 1. 1913

152. 2. 1913

153. 3. 1913

154. 4. 1913

155. 5. 1913

156. 6. 1913

157. 7. 1913

158. 8. 1913

159. 9. 1913

160. 10. 1913

161. 11. 1913

162. 12. 1913

163. 1. 1914

164. 2. 1914

165. 3. 1914

166. 4. 1914

167. 5. 1914

168. 6. 1914

169. 7. 1914

170. 8. 1914

171. 9. 1914

172. 10. 1914

173. 11. 1914

174. 12. 1914

175. 1. 1915

176. 2. 1915

177. 3. 1915

178. 4. 1915

179. 5. 1915

180. 6. 1915

181. 7. 1915

182. 8. 1915

183. 9. 1915

184. 10. 1915

185. 11. 1915

186. 12. 1915

187. 1. 1916

188. 2. 1916

189. 3. 1916

190. 4. 1916

191. 5. 1916

192. 6. 1916

193. 7. 1916

194. 8. 1916

195. 9. 1916

196. 10. 1916

197. 11. 1916

198. 12. 1916

199. 1. 1917

200. 2. 1917

201. 3. 1917

202. 4. 1917

203. 5. 1917

204. 6. 1917

205. 7. 1917

206. 8. 1917

207. 9. 1917

208. 10. 1917

209. 11. 1917

210. 12. 1917

211. 1. 1918

212. 2. 1918

213. 3. 1918

214. 4. 1918

215. 5. 1918

216. 6. 1918

217. 7. 1918

218. 8. 1918

219. 9. 1918

220. 10. 1918

221. 11. 1918

222. 12. 1918

223. 1. 1919

224. 2. 1919

225. 3. 1919

226. 4. 1919

227. 5. 1919

228. 6. 1919

229. 7. 1919

230. 8. 1919

231. 9. 1919

232. 10. 1919

233. 11. 1919

234. 12. 1919

235. 1. 1920

236. 2. 1920

237. 3. 1920

238. 4. 1920

239. 5. 1920

240. 6. 1920

241. 7. 1920

242. 8. 1920

243. 9. 1920

244. 10. 1920

245. 11. 1920

246. 12. 1920

247. 1. 1921

248. 2. 1921

249. 3. 1921

250. 4. 1921

251. 5. 1921

252. 6. 1921

253. 7. 1921

254. 8. 1921

255. 9. 1921

256. 10. 1921

257. 11. 1921

258. 12. 1921

259. 1. 1922

260. 2. 1922

261. 3. 1922

262. 4. 1922

263. 5. 1922

264. 6. 1922

265. 7

II. Review of the ...
...
...
...

...
...
...
...

...
...
...
...

...
...
...
...

...
...
...
...

THUNDER STORMS

At first by rising air
then condensation level up to
level of free convection.

after that the
clouds rise on
for by themselves

like Packer area
in much larger
Thunderstorm will
be violent.



Are more thunderstorms

where the lifting is done
by convective radiation.

Frontal - at cold front or behind
cold front if there are secondary fronts.
~~Warm~~ advances of warm front -
included thunderstorms -

Cold front type at front
Warm front type in front of front

AIRCRAFT IDENTIFICATION

SYSTEMATIC RECOGNITION

1. SIZE

- A. Wings
- B. Fuselage
- C. Tail Units

2. WINGS

A. TYPE 1. Shape

- (a) Rectangular
- (b) Tapered
- (c) Leading & Swept Ed.
- (d) Thin Ed. + panel
- (e) Wings swept back
- (f) Elliptical

2. Position

- (a) Low wing
- (b) Mid wing
- (c) High wing

3. Post

- (a) Horizontal
- (b) Dihedral
- (c) Inverted Gull wing
- (d) Gull wing

B. TAIL SURFACES

- A. Single fin & Rudder
- B. Double
- C.

3. ENGINES

1. Number

2. Type - pusher or tandem or turbo

4. Fuselage

5. Undercarriage

E. Reconnaissance

GERMAN PLANES

I Me 109

- a. Looks like $\frac{1}{2}$ - $\frac{2}{3}$ machine gun the prop.
- b. Armament - 1 - 20 Mm gun + machine
- c. Gas tank under pilot seat.
- d. Looks very fast - 1st class Pilot
- e. Not too fast without 1st Pilot

II Me 110

- A. Looks like B25. Low fuselage
- Low wing, Twin engine, Low tail
- B. 5000 ft. Speed to 10000 ft. in 10 sec
- 2 to 3 place

III He 111 A Scout Long range Long body

- A. Low wing, dump back
- Twin all-cooled engines
- Notches in trailing edge of
- 1. wing where they join fuselage.
- B. Armament very heavy.

IV Ju 88 Used as Dive Bomber

- A. 2 long short curved air scoops, one behind
- engine nacelles, swept tail
- B. Low fuselage

IV Do 172 *underwing wing*

4. Tuna ~~tail~~ *Heber & Tail*

5. Nose very heavy, short & curved

6. High black rimmed

4 very long fuselage - flying pencil

th

VI Do 183

High wing tail

4 engine engine 5000

2. 10000

~~inter~~ *gull wing*

Do 184

High wing tail

4 engine engine 5000

2. 10000

Do 185

one tail

High wing tail

3 engine engine 7000

2. 10000

2. 10000, 10000

Do 186

High wing tail

3. 10000

High wing tail

Laurel

I Mitsubishi

Swampy, slightly higher
than the surrounding area
darker green

II. M. M. M.

Swampy, lower than
the surrounding area
2-30 feet wide

III. K. M. M. P. H.

Swampy, lower than

IV. Z. M. M. 25-30 - 1300 ft

Swampy, lower than
the surrounding area
2-30 feet wide
2-30 feet high
5-6 feet wide

Swampy, lower than
the surrounding area
3-4 feet wide
fug.

Swampy, lower than
the surrounding area

Swampy, lower than
the surrounding area
11-12 feet

EQUIPMENT

AT-8 & AT-17

STRUCTURE

AT-8

AT-17

Engines: 2-R-680-9 Lycoming 2-R-755-9, Jacobs
220HP 2300RPM 56" L. 225HP 2100RPM 56" L.
290HP for Takeoff 245HP for Takeoff

Propellers

Two Hamilton Constant speed

Landing Gear & Flaps

Electrically operated

Fuselage & Wing

Mostly wood, some tubing & metal

LANDING GEAR

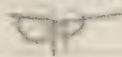
Chain driven screw drive run by electric motor.

locks when wheels are

Emergency Landing gear crank

1. Check fuse & right side of battery
2. Put landing gear switch in "off" position
3. Insert crank and turn 3 or 4 times (down)
4. Remove Crank and try switch in down position.
5. If switch does not work again place it on "off" and crank gear all the way down (191 turns)

WARNING DEVICES

1. Flare horns - blow when throttle is 1st
2. Auto sign indicator - 
3. Visual

JARVIS FEATURES

1. Safety lock (when on ground)
2. Limit Stops (up and down)
3. Hand crank

FLAPS - Screw actuated + chain drives
one motor to each flap

AT-8

BRAKES - Multiple disc - Borg & Beck.

AT-17 Expansion shoe type.

Tech. Orders - 00-25-5 - Procedure for Fire
during flight

01-1-17 - Flaps multi-engine airplanes
with one or more engines
useless.

01-1-60 - Use of Flaps

02-1-29 - Ground operation instructions
for multi engines.

02-15AB-1 - Operation and flight instructions
R-680-7 engine

03-20CA-1 - Operation and flight instructions
of Constant speed propeller
governors.

03-20CB-1 Operations & F.I. of Hamilton
controllable Propellers.

01-125KA-1 Operations of AT-8 Airplane,

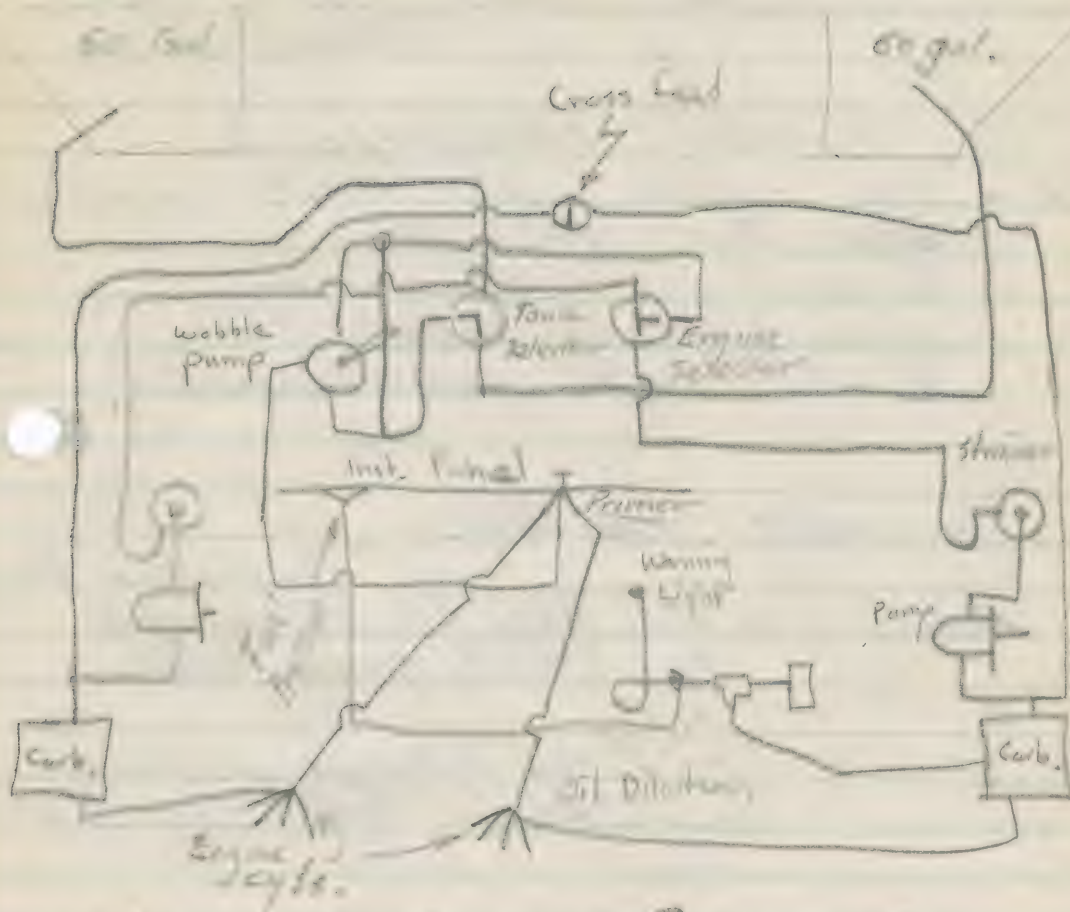
Jacob's Engine ices up more readily
than Lycoming.

FUEL SYSTEM

120 Gal

2-4 #/sq in fuel pressure

2 engine driven fuel pumps with cross feed.



Start. Cross feed off ① to keep from flooding idling engine

② to test pumps & fuel lines.

Take OFF (ON) in case one pump fails on take off.
FLIGHT - Either way - better off.

1. Tank
2. Tank Selector
3. Engine Selector
4. Shifter
5. Pump
6. Cam
7. Variable pump
8. Primer
9. Cross Feed

Gas Consumption max. 17.5 gal/hr.
 normal 13.7-14.2 gal/hr.

Oil Systems 2.8 gals/hr/engine

2 - 5 gal capacity hopper tanks

Hopper Tank advantages

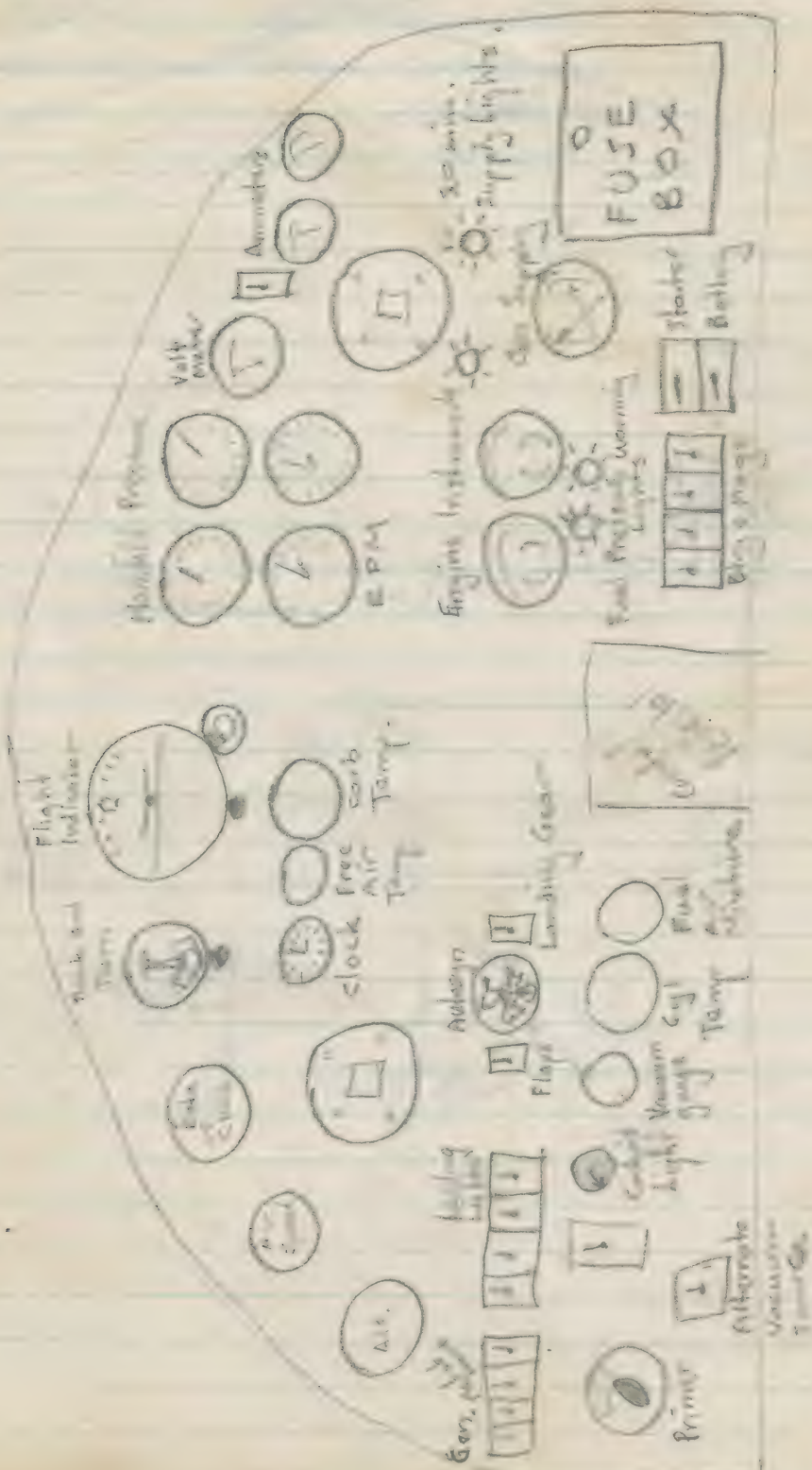
1. Oil delivery in hopper only
2. No oil change necessary
3. Oil in hopper counts up quickly.

CONSTANT SPEED PROP.

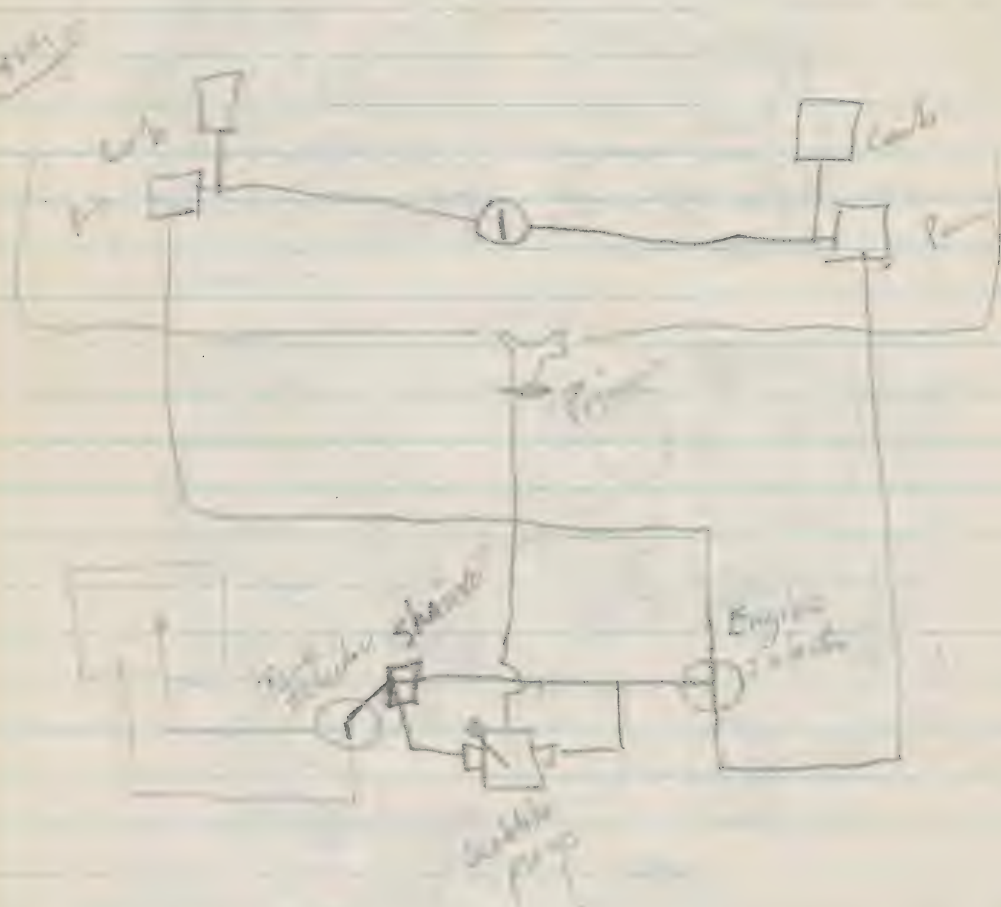
Movement to High Pitch { Counterweights (constant of force)
 Low RPM { Spring Actions

" " Low Pitch { Engine Oil Pressure
 High RPM { (180" - 200" / in²)

INSTRUMENTS

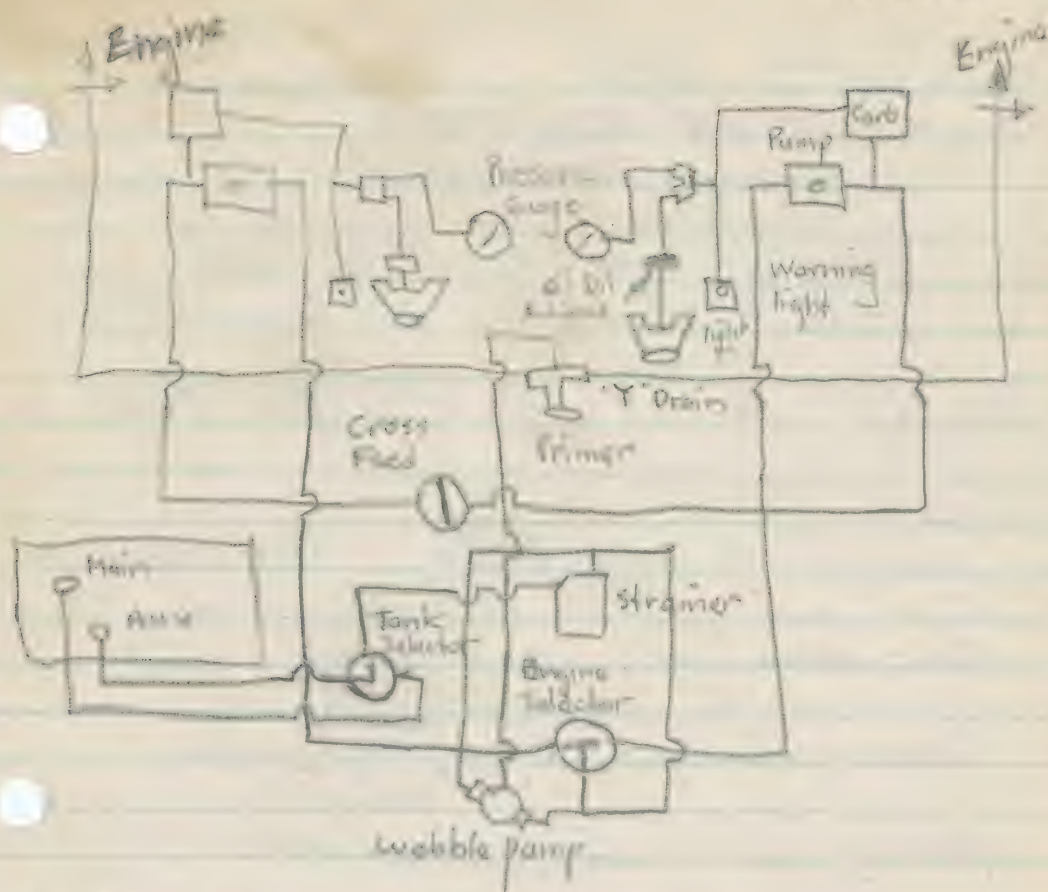


Even Lines	Tank	Arbuckle Pump
	Tank selector	Primer
	Engine selector	Cross Feed
	selector	
	Reserve Cables	



AT-9

W5 Gal Total
130 Normal



1. Tank
2. Tank selector
3. Strainer
4. (Wobble pump + Primer)
5. Engine selector
6. Pump
7. Carburetor
8. Crossfeed

Lockheed 3 D-29

Weight Empty 58 1870-205 A

Empty Weight 58
Capacity 130
Fuel 14

HP is 1000 @ 2300 RPM @ sea level
" 1200 @ 2500 RPM for take off

Take off MP = 40-45 in. Max = 45.5 inches

FUEL

Cap. of 4 wing tanks 536 imperial gal.

Can drop all

Consumption 37.5 gal/hr/engine

Imperial gal = 5 U.S. quarts.

To prime - install 4 #/in²

start 10 #/in²

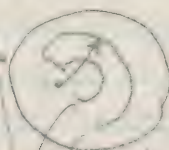
Normal operating 15-16 #/in²

warning lights come on 10-15 #

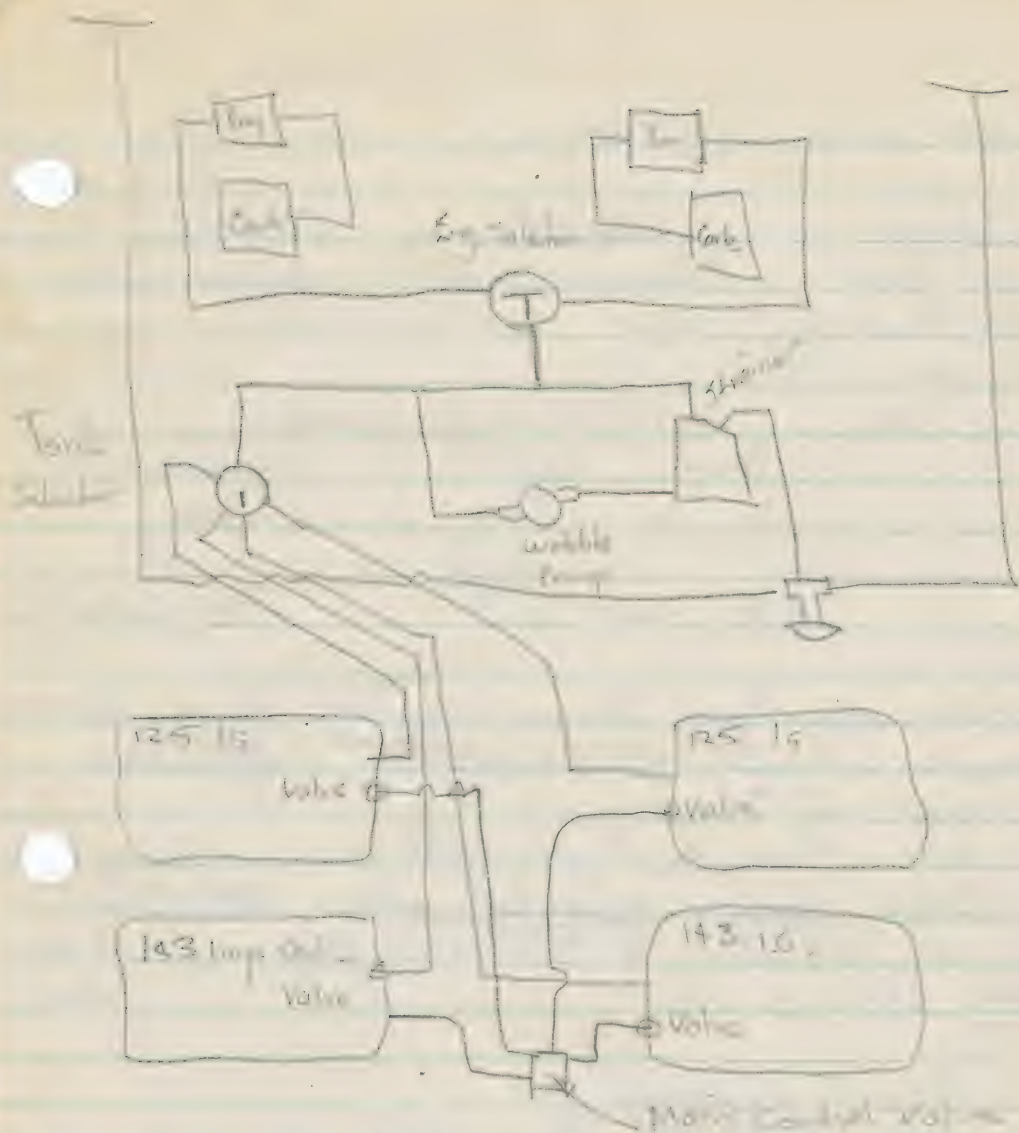
Fuel Gauges - 2 in no. Gauge

Carb. Pressure Metering Type

1. Practically sea-level only when on wing
2. Sprinkles & fluctuates in sea altitude



Carburetor for sea level
works for ground



{ Take off on Right Rear
 { Level off on Left Front for 30 mins
 + balance loads

{ E. FRONT
 { L. REAR
 { L. FRONT
 { R. REAR

— Load, has stand life
 + 83 after other gas has
 been changed

HYDRAULIC SYSTEMS

MAIN

Leading Gear
T. gear (lower off)
Rear Gear
Auto Pilot

DIKE

Longman Leading
Gear

BRAKES

Multiple Disc.

Pressure Gauge

Left Pump

Right Pump

System



450 - 650 psi

0 - 450 psi

When operating main system, pump pressure gauges register 450 - 650 psi & system pressure 0 psi .

When flaps or L. gear etc are in flaps, system pressure should show 450 psi .

This is due to all the flaps or wheels are down.

Safety Devices

1. Hand pump
2. Solenoid Lock - locks handle in down position
3. Lock down - spring loaded lock that holds gear in full down position
4. Trip relief valve
5. System relief (900 psi)
6. Pressure regulation
7. Check Valve

WARNING DEVICES

1. Klaxon Horn
2. Light indicator
3. System Pressure gauges



check up
Red
check down
Green

EMERGENCY Procedure

1. Try to get 50% flaps (@ 100 knots)
2. Slow to almost stall
3. Landing gear lower "down"
4. Nose down in glide @ 100 knots
5. Jaws nose up which shows
surfaces and of needles and
works aux pumps to lower
them down the last 18'

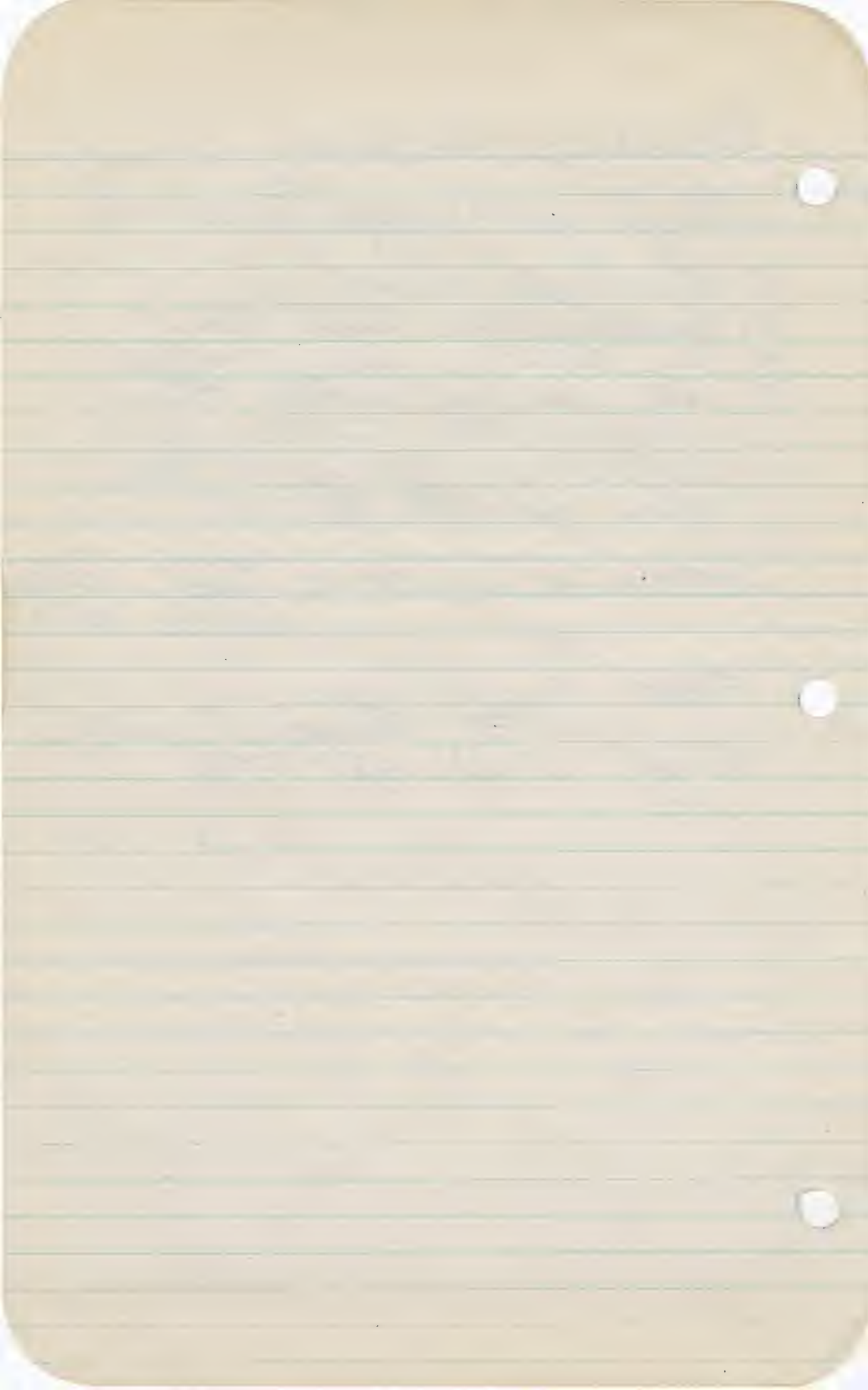
Speeds for Lowering Flaps 100 knots
Landing gear 125 "

Flaps - Fowler Type

Guage



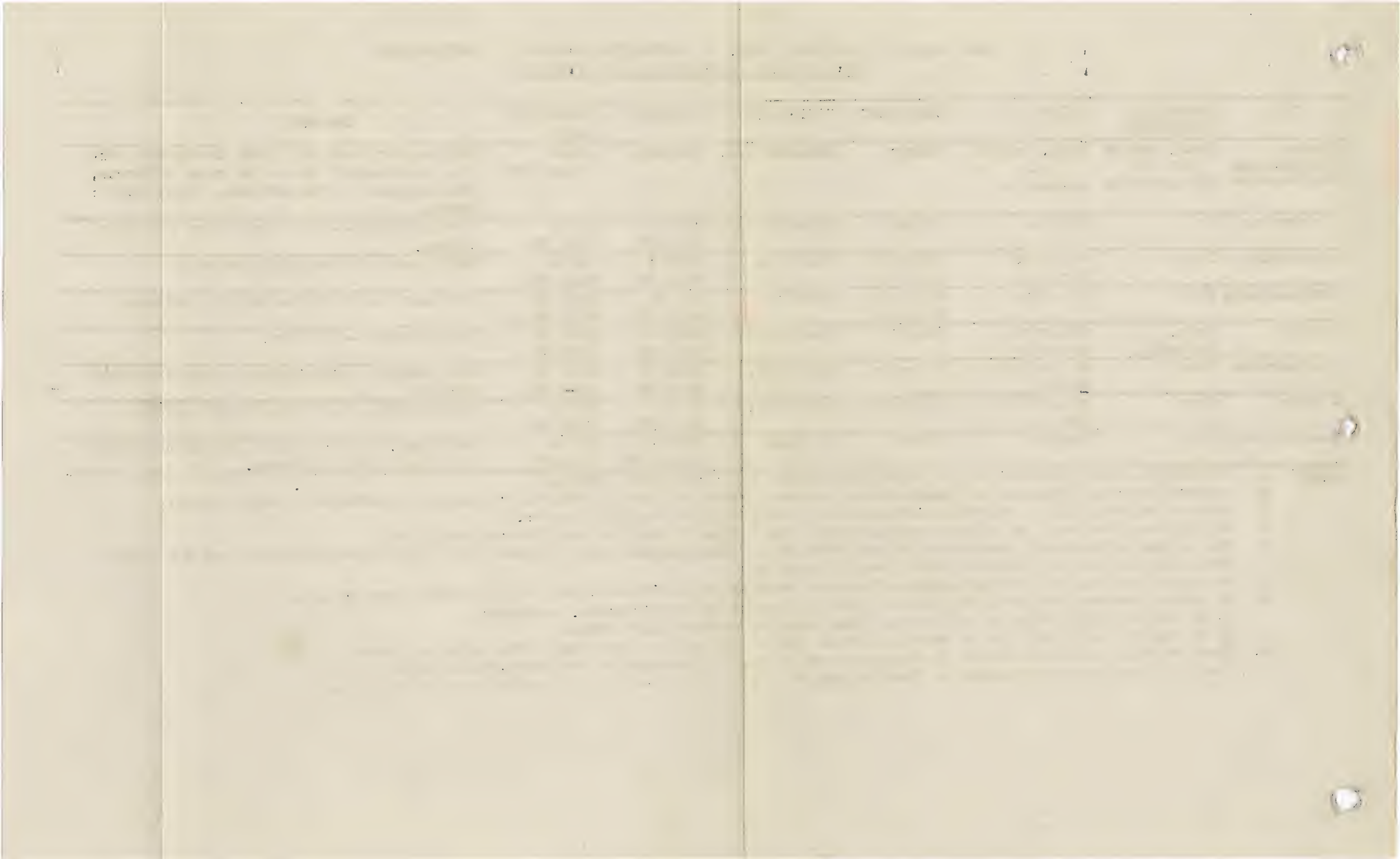
indicated by needle
at 100%



PAN AMERICAN AIRWAYS, INC., - NAVIGATION SECTION - METEOROLOGY
Navigation and Tactical Use of Clouds

TYPE	DEGREE OF CONTINUITY	ICING	TURBULENCE	VISIBILITY	THICKNESS	HEIGHT OF BASES	REMARKS
Cirrus Cirrostratus Cirrocumulus	Poor, except good in Cirrostratus	None, except in carburetor	Slight	500-1000 yds.	Variable	Above 15,000 FT	Useless for evasion. White background makes easy spotting of planes in or under Cirrus, Cirrocumulus or Cirrostratus, especially at night.
Altostratus	Good	Slight	Slight	100-200 yds.	1000 to 4000 FT.	Above 8000 FT	Most suitable -- Can be used for formation flying.
Alto cumulus	Poor	Slight to Moderate	Slight to Moderate	20-25 yds	2000 to 4000 FT	Above 8000 FT	Can be used for temporary evasion.
Stratocumulus	Fair	Moderate	Slight to Moderate	20-25 yds	500 to 4000 FT	1000 to 4000 FT	Most used due to frequency and altitude.
Stratus	Poor, Variable	Slight to Moderate	Slight	20-25 yds.	1000 to 4000 FT	Zero to 2000 FT	Not suitable -- Too low.
Nimbostratus	Good	Moderate to Severe	Moderate	10-15 yds.	6000 to 8000 FT	Zero to 1000 FT	Not suitable. Continuity is only favorable factor.
Cumulus	Poor	Moderate to Severe	Moderate	15-20 yds.	Up to 8000 FT	800 to 2000 FT	Not suitable. All factors unfavorable.
Cumulonimbus	Poor	Severe	Severe	10 yards	1500 to 20,000 FT	600 to 1600 FT	Dangerous. Can be entered in Cirrus at top for evasion from fighters.

- NOTES:**
1. All clouds, except Cirro-form, are with the attacker and against the defender.
 2. Convection clouds (Cumulus and Cumulonimbus) in the daytime may help a navigator to locate a continent or large island.
 3. Lack of radiation fog in certain continental areas may indicate bodies of water.
 4. Sea fog over the ocean at night looks very much like a mass of land and may fool the navigator.
 5. The leaning of vertical development clouds (Cumulus and Cumulonimbus) will indicate the most favorable flight level for a fast trip, but does not indicate the actual wind direction.
 6. The winds over the top of Strato-type clouds are usually quite different from the winds below the clouds.
 7. In passing through any type of northern hemisphere front in any direction, remember:
 - a. If you had right drift it will become less right or possibly left drift.
 - b. If you had left drift before crossing front, there will be more left drift after crossing front.
 8. These rules are reversed in the Southern hemisphere and do not apply to the inter-tropic front.
 9. Beware of shadows from Cumulus and Cumulonimbus clouds on water -- they frequently look like islands.



U. S. DEPARTMENT OF AGRICULTURE
WEATHER BUREAU

EXPLANATION OF SYMBOL WEATHER REPORTS
(based on instructions contained in Weather Bureau Circular N 1939)

[To illustrate the method used in transmission and deciphering of symbol weather reports, the following example of such a report is given. Each element of the report is connected by a line with a description of all symbols and conditions which might be used in that particular phase of the report. Elements of observations are always transmitted in the same order; therefore all symbol weather reports may be deciphered by reference to this chart]

WA		C	SPL	1624E	E30 ⊕ 15 ⊕ 2VT-R-BD-			152/68/60 → \ 18- ↑ 1618E			996	+ ⊕ NW														
Station	Classification of report	Type of report	Time of report	Ceiling	Sky	Visibility	Weather	Obstructions to vision	Barometric pressure	Temperature	Dew point	Wind	Altimeter setting	Remarks												
Lists of station names and their representative call letters are posted on Weather Bureau airport station bulletin boards for the information of all concerned.	The symbols C, N, or X are used immediately following, after 1 space, the station letters to classify weather conditions at airports specifically designated as controlled airports. If no classification letter is used the station is not located at a controlled airport. C: Satisfactory for contact flight. N: Requiring observance of instrument flight rules. X: Take-off and landing suspended.	"SPL," meaning "special report," appears when crucial changes have occurred in weather conditions since the last report. The absence of the observation-type letter group "SPL" indicates an observation where no crucial changes have occurred since the last transmitted observation. "LCL," meaning "local extra observation," appears only on reports sent over local circuits. Such reports are made every 15 minutes during periods of low ceiling and/or visibility. "SPL" reports appearing in sequences do not show the time of report group and the time of observation is considered as the time of all other reports in the sequence as indicated in the sequence heading.	Time groups are in figures based on the 24-hour clock, with following letters showing the standard of time used, e. g., "1440E" means 2:40 p. m., Eastern Standard Time; "0030C" means 12:30 a. m., Central Standard Time; "2359M" means 11:59 p. m., Mountain Standard Time; "2015P" means 8:15 p. m., Pacific Standard Time, etc. "SPL" reports which are sent alone and all "LCL" reports bear the time of observation immediately following, after 1 space, the observation-type letter group "SPL" or "LCL." "SPL" reports appearing in sequences do not show the time of report group and the time of observation is considered as the time of all other reports in the sequence as indicated in the sequence heading.	The absence of a "ceiling" group indicates an "unlimited" ceiling (above 9,760 feet). Figures representing the number of hundreds of feet which apply are used to indicate the height of the ceiling between 51 and 9,760 feet, inclusive, above the station, e. g., "35" indicates 3,500 feet, "3" indicates 300 feet, etc. The figure naught (0) is used when the ceiling is zero (below 51 feet). When the height is estimated the letter "E" precedes the ceiling figures. A plus sign (+) is used preceding the ceiling figures to indicate the ceiling balloon was blown from sight at the height represented by the figures and before reaching the clouds. The letter "V" is used, immediately following the figures for ceiling, if the height of the ceiling is changeable and below 2,000 feet.	The absence of a symbol for sky indicates that precipitation or obstructions to vision are present and reduce the ceiling to zero and/or the visibility to one-fifth mile or less and make the sky unobservable. The sky condition is indicated by the following symbols unless the condition given above is present: ⊙ Clear. ⊙ Scattered clouds. ⊙ Broken clouds. ⊙ Overcast. ⊙/ High scattered. ⊙/ High broken. ⊙/ High overcast. ⊙⊙ Overcast, lower broken. ⊙⊙ Overcast, lower scattered. ⊙⊙ Broken, lower broken. ⊙⊙ Broken, lower scattered. ⊙⊙ Scattered, lower broken. ⊙⊙ Scattered, lower scattered. ⊙⊙ High overcast, lower broken. ⊙⊙ High overcast, lower scattered. ⊙⊙ High broken, lower broken. ⊙⊙ High broken, lower scattered. ⊙⊙ High scattered, lower broken. ⊙⊙ High scattered, lower scattered. The plus (+) or minus (-) sign preceding the cloudiness symbol indicates "dark" and "thin," respectively. Height of lower scattered clouds is indicated by the entry of a figure, representing the hundreds of feet applying, immediately preceding the scattered clouds symbol.	The absence of a figure for visibility indicates that the visibility is 10 miles or more. The value of the visibility below 10 miles is indicated by figures representing the number of miles and/or fractions of miles. The letter "V" is used, immediately following the figure for visibility, if the visibility is fluctuating rapidly and is 2 miles or less.	The "weather" element of the report is indicated, when appropriate, by the following symbols: R- Light rain. R+ Moderate rain. R- Heavy rain. S- Light snow. S+ Moderate snow. S- Heavy snow. ZR- Light freezing rain. ZR+ Moderate freezing rain. L- Light drizzle. L+ Moderate drizzle. L- Heavy drizzle. ZL- Light freezing drizzle. ZL+ Moderate freezing drizzle. ZL+ Heavy freezing drizzle. E- Light sleet. E+ Moderate sleet. E- Heavy sleet. A- Light hail. A+ Moderate hail. A- Heavy hail. AP- Light small hail. AP+ Moderate small hail. AP+ Heavy small hail. OP- Light snow pellets. OP+ Moderate snow pellets. OP+ Heavy snow pellets. SQ- Mild snow squall. SQ+ Moderate snow squall. SQ+ Severe snow squall. RQ- Mild rain squall. RQ+ Moderate rain squall. RQ+ Severe rain squall. T- Mild thunderstorm. T+ Moderate thunderstorm. T+ Severe thunderstorm. SW- Light snow showers. SW+ Moderate snow showers. SW+ Heavy snow showers. RW- Light rain showers. RW+ Moderate rain showers. RW+ Heavy rain showers. TORNADO (always written out in full).	The "obstructions to vision" element of the report is indicated, when appropriate, by the following symbols: F-- Damp haze. F- Light fog. F Moderate fog. F+ Thick fog. FF Dense fog. GF- Light ground fog. GF Moderate ground fog. GF+ Thick ground fog. OFF Dense ground fog. IF- Light ice fog. IF Moderate ice fog. IF+ Thick ice fog. IFF Dense ice fog. H- Hazy. K- Light smoke. K+ Moderate smoke. K+ Thick smoke. D- Light dust. D+ Moderate dust. D+ Thick dust. BS- Light blowing snow. BS Moderate blowing snow. BS+ Thick blowing snow. GS- Light drifting snow. GS Moderate drifting snow. GS+ Thick drifting snow. BD- Light blowing dust. BD Moderate blowing dust. BD+ Thick blowing dust. BN- Light blowing sand. BN Moderate blowing sand. BN+ Thick blowing sand.	The barometric pressure is indicated by a group of 3 figures; tens, units, and tenths of millibars involved. Thus a pressure of 1015.2 millibars would be written as "152"; 999.9 as "999"; 1025.7 as "257", etc. Sent only by stations equipped with mercurial barometers.	Temperature is indicated by figures giving its value to the nearest degree Fahrenheit. Values below zero Fahrenheit are indicated by the entry of a minus sign (-) immediately preceding the figures for temperature. Zero is entered as "0."	Dew point is indicated by figures giving its value to the nearest degree Fahrenheit. Values below zero Fahrenheit are indicated by the entry of a minus sign (-) immediately preceding the figures for dew point.	The wind direction is indicated by arrows, as follows: ↓ North. ↘ North-northeast. ↙ Northeast. ← East-northeast. ← East. ↖ East-southeast. ↘ Southeast. ↑ South-southeast. ↑ South. ↗ South-southwest. ↘ Southwest. → West-southwest. → West. ↙ West-northwest. ↖ Northwest. ↗ North-northwest. The velocity is indicated by figures representing its value in miles per hour, "calm" being indicated by the letter "C". If estimated, this is indicated by the entry of the letter "E" immediately following the velocity figure. The character of the wind is indicated, when appropriate, by entry, immediately following the velocity, of a minus sign (-) for "fresh gusts" and a plus sign (+) for "strong gusts." No indication of character means the wind is steady. Wind shifts which have occurred at the reporting station are indicated, immediately following the other wind data, by an arrow showing the direction (to 8 points only) from which the wind was blowing prior to the shift, followed by the local time, on the 24-hour clock, at which the shift occurred, with following letter showing the standard of time used. The intensity of the shift is indicated by the minus sign (-) for "mild," the absence of a sign for "moderate," and the plus sign (+) for "severe." The signs being entered immediately following the standard of time letter.	Indicated by a group of 3 figures representing the inch and hundredths of an inch of pressure involved. Thus, 30.00 would be written as "000"; 29.98 as "998", etc. Sent only by designated stations equipped with mercurial barometers.	Remarks are transmitted in authorized English abbreviations and teletype symbols. Lists of the abbreviations are available for inspection at all Weather Bureau Airport Stations. The teletype symbols used are shown on this chart.												
															Special data											
															Special data comprising pressure change and characteristic, 5,000-foot pressure at selected stations, cloud, thunderstorm, and snow depth data, Great Lakes water temperatures, etc. data from selected stations, etc., are entered in code at certain times by the stations designated to do this, as separate groups, immediately following the report proper. These data are included primarily for the preparation of maps for forecasting.											
															Missing data											
Elements normally sent, but for some reason missing from the transmission, will be indicated by the letter "M" entered in the report in place of the missing data.																										

For example, the report given above would be deciphered as follows: Washington—sky more than nine-tenths covered but with breaks; satisfactory for contact flight; special report at 4:24 p. m., Eastern Standard Time, ceiling estimated at 1,000 feet; overcast, lower scattered clouds at 1,000 to 2,000 feet; visibility 2 miles; weather: light rain; temperature 68° F.; dew point 60° F.; wind west-northwest 18 miles per hour, fresh gusts, moderate wind shift from the south at 4:18 p. m., Eastern Standard Time; altimeter setting 29.96 inches; dark clouds in the north-east.

Sequence Remarks

Left out every hour on the left hand.

Metecology ~~Chart~~ ✓



— worst weather here
is cyclonic rotation

1. Uneven Temp on earth surface cause
of weather, winds etc.
2. Rotation of earth cause pressure areas
3. High pressure areas move 25 to 30
mph
4. Warm Fronts - approaching -
Increasing ~~temp~~ and lowering
stratiform clouds and rain
as front arrives
Passing - intermittent showers
then clearing weather.
5. Approach of Cold Front
Brief heavy showers, cumulonimbus
clouds, squall line 200 mi
or more long. Cannot go
under, over, or under.
Passage - clearing weather
drop in temp + wind shift.
6. Iceing - 26° to 30° F. Free Air
Temp
Other temp stay out of rain clouds.
7. A. 2% $\frac{1}{5}$ th lapse rate free air average
Never take off with frost on
wings and control surfaces because
of skin friction.

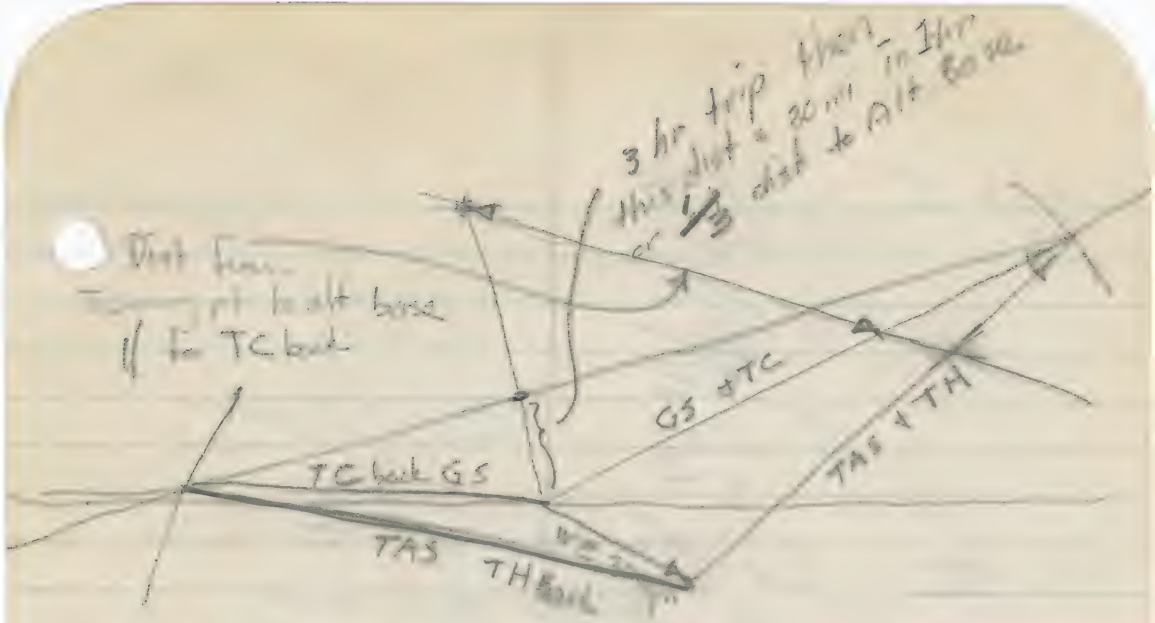
$$\begin{array}{rcl}
 \text{TC} & = & 75^\circ \\
 & + & 4^\circ \\
 \text{CH} & = & 79^\circ
 \end{array}
 \qquad
 \begin{array}{rcl}
 \text{Alt } +5^\circ & & \\
 \text{Gr. } -3^\circ & & \\
 \text{Dr. } +2^\circ & & \\
 \text{Corr } +4^\circ & &
 \end{array}$$

Interception Problem



R/A Problem to Alt. Base

How far can plane scout on a course of 60° before returning to Alt. Base that bears 350° & 90 mi from Alt. Base? Alt. Base 730° @ 30 mph - Course @ 150 mph TAS
Find R/A for 3 hr flight.



$$\text{Time of trip} = \frac{T \times S_2 (\text{altitude})}{S (\text{altitude of Obj}) + S_2}$$

time out

$$\text{Dist} = t \times GS_{\text{out}}$$

Case I

$$\begin{array}{r} TC \\ \pm \frac{V_{cr}}{MC} \\ \pm \frac{Dev}{CC} \\ \pm \frac{wind}{CH} \end{array}$$

add right wind
subtract left wind

Case II

Rectifying

$$\begin{array}{r} CH \\ \pm \frac{wind}{CC} \\ \pm \frac{Dev}{MC} \\ \pm \frac{V_{cr}}{TC} \end{array}$$

subtract right wind
add left wind

Given: $TC = 145^\circ$

Var. = $5^\circ E$.

Dev. = $3^\circ W$.

Wind from $190^\circ @ 10$ mph

TAS = 120 mph

Dist A to B = 163 mi

Find: G.S.O. = 97 mph

G.S.R. = 139 mph

C.H.O. = 153°

C.H.R. = 313°

Time to make Round Trip =

E/A for 4 hrs Fuel = 228

$TH_0 = 155^\circ$

Var. = $5^\circ E$

$MH_0 = 150^\circ$

Dev. = $3^\circ W$

$CH_0 = 153^\circ$

$TH_R = 315^\circ$

-5°

310°

$+3^\circ$

$CH_R = 313^\circ$

$$T_0 = \frac{163}{97} =$$

$$T_R = \frac{163}{139} =$$

Time Round Trip =

$$E/A = \frac{G.S.O. \times G.S.R.}{G.S.O. + G.S.R.} = \frac{97 \times 139}{97 + 139} = \frac{97 \times 139}{236} = 228$$



Communications TM 24-5

Message - transfer of any thought from one person to another.

How to send Messages

1. In Person (Message Center net)
2. Telephone (unavailable)
3. Messenger
4. Telegram & Radioteletype, Letter
5. Radio - unsolved & fast but unreliable

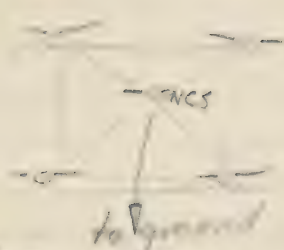
Radio Message Priority - 1st & 2nd

O - Urgent - when in contact with enemy

P - Priority - all other urgent

Routine - within 24 hours

D - ~~Deferred~~ - office hours next day



Five plane patrol mission
etc. one plane (sensitive ship)
called NCS [Net Control Ship]

NCS makes record of all messages in net and 5 minutes out of hour say he changes trans. frequency & contacts ground stations and relays all messages.

Cipher - letters transposed or substituted.

used for messages of immediate importance

Secret Code - used for information of lasting importance.

Prearranged Signals

Plans 1 - AB
 2 - BC
 NCS+ 3 - CD
 4 - DE
 5 - EF

Group Not Call Up
 FE

Message AB (from) (go ahead) 10 10:33

2 - Radio & message

A - Affirming message etc.

B - did not get my call etc.

C - Contact

D - deferred

E - do not answer the following message

F - Report back

G - Verify message AB V CO I 10 33

K - Go Ahead

L - Forward Message to other in net

M - Pass message thru —

N -

O - Obvious

P - Priority

Q - Information address

R - (Repeat) received message

T - Transmit

V - from

W - amount of interference

X - man made

Y - Is message understood

Z - originator

Message Center

1. Knows what facilities on hand would be most expedient -

2. Insures against loss of message by keeping log of receipt & delivery.

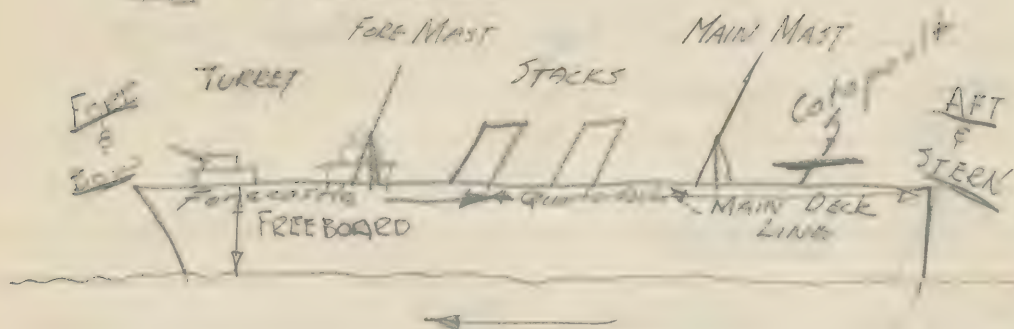
Usefulness of means of transmission

1. Messenger - in order of the
2. Visual - ability to be
3. Sound - safeguarded
4. Wire -
5. Radio -
6. Pigeons -

IDENTIFICATION OF NAVAL VESSELS

TYPES OF VESSELS

- I BATTLESHIPS
- II CRUISERS
- III DESTROYERS
- IV CARRIERS



MAST TYPES

I STICK OR SIMPLE (British designation)

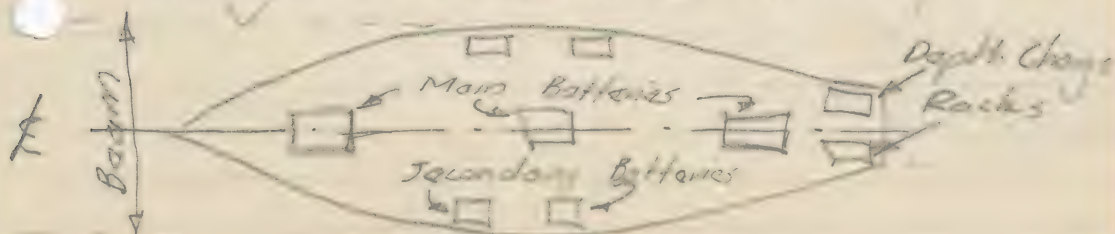
II TRIPOD

III CAGE - interwoven pipes (used by Americans)
(Battleships only)

SUPERSTRUCTURE - Any compartments built above the main deck line. Does not include masts, stacks, vents, turrets, etc

STACKS - one to four

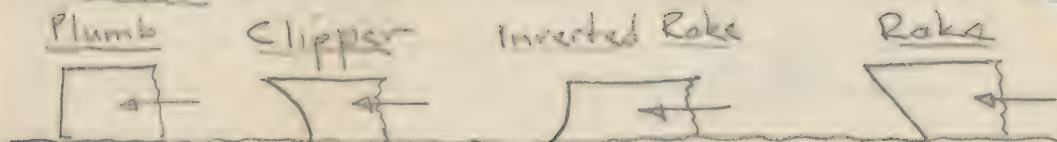
MAIN BATTERY - ships longest guns always located in $\perp$ of ship



CATASTROPHY - good means of identification
not on destroyers

<u>SHIPS</u>	<u>GUNS</u>	2-16" to turret, 3-14" ^{to} turrets Beam to length ratio approx 1 to 6 Protective armor corresponding to gun caliber. Missile launchers. Armor plating.
Battleship	12"-16"	
Light Cruisers	6"	Beam to length Ratio 1 to 10
Heavy Cruisers	8"	
Carriers	None U.S. Seaplane car. built	
Destroyers	5" Single gun	Depth charges

BOWS



STACKS Straight on battleships



Japanese type

Americans use terms type superstructure

- All U.S. Battleships
 1. Catapults on 2nd turret and one on stern
 2. Coys masts, ^{Colorado 2} 2-16" guns ^{main gun} 3-14" guns per turret
 3. All U.S. battleships have large central towers
 4. Tripod Masts
 a. New York & Texas - oldest U.S. ships
 5 turrets with 2-14" guns on no cat on stern
 b. Single stack ships have stack forward near Mast
 German & Jap ~~ships~~ stacks centered between masts.
 c. Oklahoma & Nevada - 3-2-2-3 gun arrangement
 5. New Battleships
 North Carolina - two side by side stacks
 two catapults on stern
 6. All catapults aft of stacks
 7. German Battleship has more than 5 guns & turret

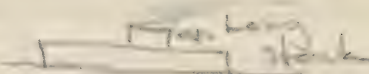
BRITISH SHIPS

only ships that have stationary ^{catapult} across
mid-ship are British

King George V class only class of British
Battleship that has { unbroken deckline
2 stacks

Nelson & Rodney - superstructure aft of center
widest part of ship " " "

OLD BATTLESHIPS

- 
1. Inverted raked bow
 2. Single ^{log} stack close to forward superstructure
 3. Stationary Catapult
 4. at least one very high stick mast.
 5. 4 turrets, 2 bow + 2 stern, A, B & X, Y

Battle Cruiser - Renown

1. High stick mast
2. Stationary Catapult rear of stack.
3. 2 long stacks

GERMAN

1. Undraken deck line
2. One stack centered between ^{ground line} ~~ground line~~
3. Stencil line
4. Tower type super structure
5. After brace movement on stack

JAPANESE

1. Top heavy looking - Pagoda type superstructure very high.

AIRCRAFT

- U.S. 1. Longer only ship, small stacks on each side
2. All have islands in our section except Sanctuary which is split
3. High freeboard
4. Dashed corner side ship

British

1. Light dashed corner enter hull except for Turquoise
2. High freeboard
3. Single island - very large on Engel

- Japanese - 1. No islands
2. Low freeboard

main gun
& turrets

CRUISERS Light & Heavy (Guns)

U.S. Heavy 11.

- (1) 1. 3 turrets & 3 guns to turret Heavy
 2. 3-3-3-2 guns - turrets
 (2) 2. 5 turrets & 3 guns to turret light
 Japanese - 5 turrets 3-3-3-3 guns - 2 guns

3. Searchlight platform below 2 stocks
4. Hanger of planes near Catapults
5. Breaker deck forward of catapult
6. always two Catapults together
7. (a) new bone flange
 (b) only 1 gun to turret
 (c) no lateral tower on mast
 (d) Carry depth charges
8. Gunboat - similar class
 4 stocks & central tower on forward tri-pod mast.
9. Bird cage (Radar) antennas on stick fore mast.

Destroyers - U.S.

1. Have depth charge rack on gun stem (hence models) also chemical racks for smoke screens & Y guns for throwing depth charges



Y gun



Depth charges

Chemical racks

50 4 stacks gun to British

2. 1, 2 or 4 stacks
(German & Jap destroyers all have 2 stacks)

3. Radar antenna on funnel -

4. Flotilla leader (Destroyers) ~~large~~
larger destroyer, much two gun turret, high stick mast.

Destroyers - German

1. 2 stacks
3. Superstructure around seabird stack

Destroyers - Japanese

- out type 1. Odd funnel to deckline
2. 2 stacks

second type

1. 2 stacks

2. torpedo tubes forward of main superstructure in cut in deck. 

Quick
Notes

Flags
English
U.S.
German
Japanese

Battleships
Cruisers
Destroyers
Corvettes

1. No U.S. Battleship has more than 3 guns to turret.
2. All german battleships have flood deck.
3. All U.S. ships except New York & Texas have 2 catapaults of the land only.
4. U.S. Battleships only one with eye mast.
5. Battleships in U.S. only one with only ships with two catapaults on stern.
6. Heavy & light Cruisers on same tonnage only heavy & light guns.
7. Battleships saucer (Hull form Battleships by looking, bulky and flat topped and hull).
8. No new U.S. cruisers carry torpedoes only old & obsolete do.
9. Superstructure

U.S.	—	Tateo
Jap	—	Payoda
German	—	Blow
10. All german Battleships have one stack.
11. No U.S. Battleship has a catapault forward of main stack.
12. Pocket Battleship - 11 inch guns look like Cruisers only 2 turrets 3 guns to turret.
13. German bridge next to stack.
14. Framework space between masts & main deck line.
15. German - Bulky U.S. - High foreland Jap - low foreland

16. Masts & superstructure above light
deck on cruiser - called island.
17. Jap. Cruisers have little or
no island.
18. Cruisers US - 3 masts 1 stem 2 bow
gunner 2 stern 1 low
19. American or British only one
main single stack destroyer.
20. Jap. destroyers only one with
torpedo tubes on forecastle deck.
21. Destroyers only ship carrying
depth charges - US - 2 stern
22. Jap. battleships (some) have ~~no~~
main bottom stacks -
23. Only Japs & British carry torpedoes
on battleships.
24. British Kent Class Cruisers
2 high stack masts & 3 stacks.
25. German destroyers have superstructure
around main stack.

Lostwood Pass

TELEPHONE

RECORD

DIRECTIONAL LOOP

1. OUTPOST

Dial

2. INWARD - *From the top of the mountain*
10. CAMP - *Get the top of the mountain*
12. BURN - *From the top of the mountain*
13. LOOP - *From the top of the mountain*

and { Time - *From the top of the mountain*
{ *From the top of the mountain*
100' } *From the top of the mountain*

unpublished

Name _____

No. _____

Address _____

ARMSTRONG STATION

421 Main Street,

PHONES MAIN 0448

NO. 12-U



Tactical Fire

1. Defensive Fire

2. Offensive Fire - delivered by any type plane

3. Covering Fire - Pursuit - during attack. Attack planes 1000' ahead of plane flying back

Pursuit over Bombardment

1. greater volume of fire than any plane
8 to 12 guns
13 - 13 guns
2. Stable fixed gun platforms
3. Less vulnerable sides
4. Better armored
5. Greater maneuverability
6. Short missions less pilot fatigue.
7. Only one man -

Bombardment over Pursuit

1. More easily controlled in combat.
~~2~~ because pilot only flies plane during fight.
2. Carry more ammunition.
~~3~~ Pursuit plane only 30 sec. of ammunition
3. Almost no blind spots.
4. Gunner knows about everything but firing gun -

1. Accuracy - about 3 sec total time course of about 60 rounds per gun
2. Personnel + Time factor
Gunner trained to do duty in alternate
3. Dispensing - Bombardment + fuel - high formation
4. Visual - dependent on physical comfort
5. Weather - must be such so that planes must be engaged by only flares.

Fire Coordination

1. For fire to be effective must destroy target for defensive fire
2. Offensive - reduce effectiveness of enemy fire.

Equipment - High alt - lubricator for high alt.

Observing flares

1. Red flares sighted yell "works"
2. Plane ~~seen~~ considered to be enemy until proven otherwise
3. Position indicated by hemisphere around flares
upper & lower, red & green, front & rear)

Line Control officer - has control of
all guns in formation

Concentrate fire to ~~infer~~
fire can be of most good.

FORMATIONS

Squadron wedge

Light Bombardier
maneuverably, not
dangerous if no flame
drops out, easily controlled.



Javours

1. All land fire
control, rear side
2. 7th - 1st - 2nd
3. Danger of no fire
is avoided out
4. Heavy Bombardment



STAGGER

Fast light formation
strong range
A204

Turn to face attacking
formation.
most maneuverable



COMPARISON OF THE TWO GROUPS

Infantry - mobility
+ fire power, little shock

Artillery -
Great Fire Power
Slow Movement

Cavalry - Mobility
little fire power
flexible
used for observation & attack

Armored Forces
Great fire Power
+ shock
very mobile

Air Force 1. Extremely flexible
2. Highly mobile
3. High attack power

Limited by 1. weather
2. mechanical failures
3. enemy operations

Air Force

1. Economy - one only for objectives
that cannot be taken by ground forces -

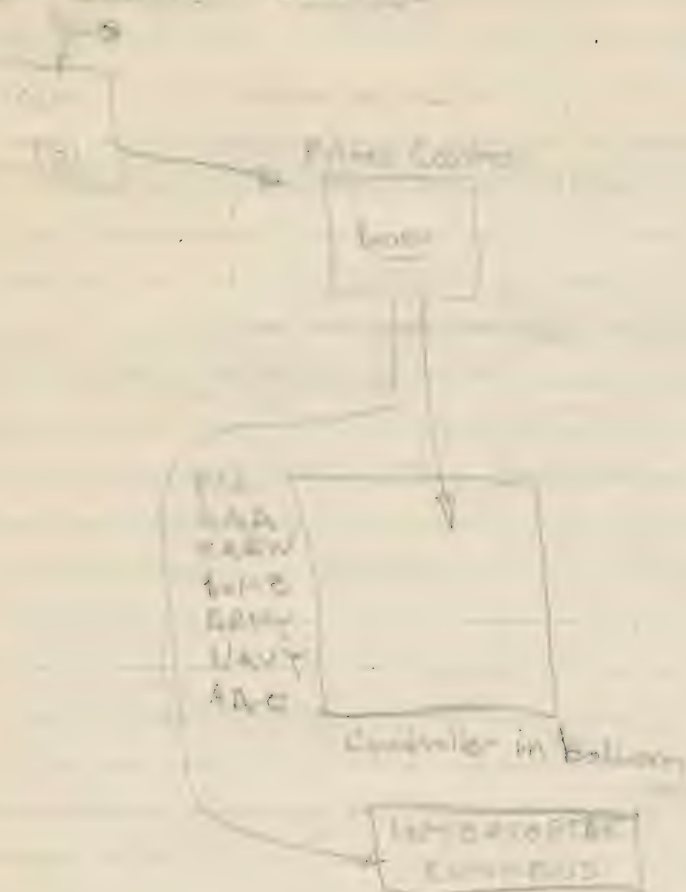
2. Mobility -

3. Flexibility -

4. Guarantee -

5. Vital Targets -

Air Warning Center



Each point of the friendly force
should have limitations such difficulties
of other branches.

AF should be given the following info:

1. Specific Target
2. Direction of Movement
3. Identification markers
4. Location of friendly troops in relation to target
and their movement
5. Time limit on action

FIELD ORDERS

found document of a General
in his instructions & many instructions & put
in effect.

7th Infantry Group

Lawler Field VA.

27 July 1946, 10 AM

Field Orders

No 5

MAPS:

1. 103 1. Enemy surface force
2. " " " "

2. 1. Friendly surface -
" " " "

2
3
4

NUMBERS

DISTRIBUTION

Signature of CO.

Combat Orders

1. Letters of Instructions

Large area movements } G-HQ
Large feeding of troops }

2. Warning Orders - Army HQ

3. Movement Orders

Not for tactical movement but
for administrative movement
of troops -

4. Field Orders

Direct tactical operation G-3

5. Admin. Orders

Supply etc by G-4

✓ Alert - plane fully serviced & ready
hours & loaded
Personnel in readiness -

15 min. to get into operation

Assembly -

Element - subdivision of flight

Initial Point - position in space at which
element or flight take off position
only to track -

Bally Point -

✓ Readiness - can take off in 1 hr.
no hours loaded

✓ Stations - any thing used, either
moving or in position for takeoff

9-3 1942

Field Order - clear, concise & comprehensive.

Par 1. contains necessary info
~~about~~ about area & military topog.
✓ Command decision

Par 2. Direction of movement
& change of plan & change of
movement, as applies to the entire
command. - Operations for entire
command - unit, column, file, platoon

Par 3. List of subordinate units.

G-4 Par 4. Intelligence, adv & supply.

G-3 Par 5. Info about situation
a. General command
b. Plan of support com.
c. Command post ground
data

Detailed Orders -

Comm Orders - usually given to entire
entire unit down to
small units - C

attached to - assigned to smaller command

Designation of places

1. Grid coordinates -

2. Reference points.

REMARKS

EXPLOSIVES -

Low 1. Black Powder 75% White
Controlled 15% Charcoal
2% Sulphur

a. 1st at under
heat
dist left in back

b. 1st in AAT

delay
starting
stabilizing

2. Trinitro cellulose powder - ^{permeable} burning

30 cal .032 dia  

gran
size

.025' long

15' diam .447' dia  

2.170 1

a. 1st - not affected by moisture

High Explosive rate of reaction can't
be controlled

1. Trinitro Toluene - most sensitive

2. Tetryl - second most sensitive

3. T.N.T. most sensitive to heat & shock
most sensitive to friction

Substitutes - Amalcol 50-50

Amalcol 80-20

ammonium nitrate, tolulol

4. Ammonium nitrate
ammonium nitrate shells

Bomb

Explosive train
to measure position
sites of houses

Explosive train of
detonator bombs



Explosive

1. Bomb to be tested must be
2. " " " " " " " " " "

all except Mercury Fulminate
and TNT are

To test bombs must be
dressed up from 4000' so that
in case bombs must be
dropped over friendly territory they
can be safely

- 3 TNT Bombs by making the
metal with a fuse or
screwed bomb the fuse will
set off TNT

SMALL ARMS AMMUNITION - 14.5 mm 1 in dia.
Case - 70% Copper, 30% Zinc
Fuller - head for 30 cal. Steel for 50 cal.
(apt)

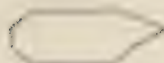
Types - Ball Ammunition

M 1906



Springfield
ground machine
gun corps
marked gun

M 1



M 2



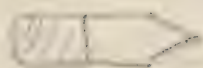
ground rifle

Armor Piercing



TEARER

50 cal. 10 in. 8 in.



EXPLOSIVE - explodes when
bullet starts on down slope of
trajectory -

GRADE

AC - aircraft machine gun

MG - ground

R - rifle

3 - unserviceable or can not
be positively identified
because broken or lost etc.

HANDLING -

1. Never grease any ammunition
because case will not grip
barrel.

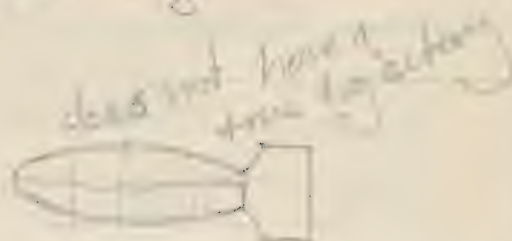
2. In case of a surface incident
 30 minutes because it might be
 a delayed fire.

Bombs Explosive - High explosive filler
 CHOMAC - Chemical
 INERT - Protection and shell base

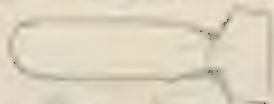
Sanitation Mark - surface targets
 Fragmentation - personnel
 Radiation - training

BOMB SERIES

Mark Series



M-Series - true trajectory, strong tail



Fragmentation Bombs carried horizontally
 then case

1000 lb
 2000 lb
 5000 lb
 10000 lb
 20000 lb
 40000 lb

Tail Assembly

Fins assembly

Just safe under 800'

Parachute safe as

low as 65'



Shed
 Bomb

Fragmentation Bombs 17, 20, 25, 30 lb
 Carried long.

50 yds 4000 - 10000

Chemical Bonds - 17° 230°

Curved vertically



INCANDISCENT BULBS

Incandescent bulbs of the type

11 1/16

2 1/16

lower 10 min. @ 2300° to 2500° F

also blue cones 4300° to 4500° F

blue melts and runs off -

T 2 Cluster holds 34 incandescents

100% luminous filled with gas
and small bubbles which
shrink to bubbles the bubble
it is still burning -

Discoloration & Fragmentation - Yellow -
Practically - Blue
Practically - Black
Chemically - Grey

1 green band - iron present
2 " " - present chem
1 yellow " - smoke
1 purple " - incandescence

FRAGMENTARY - or Roman
Columbus

Now see a bomb leaving
the mission to destroy
the church Sancta.

Drill Chart - Gun & Cannon

1. Machine Gun 50 cal 150 cal Browning
2. Cannon 20 mm Hispano-Suiza
37 mm Browning

Machine Gun & Cannon - as attached,
belt fed from either side, remote
control, cannot operate

Cannon 37 mm - 125-150 rounds/min
20 mm 300-700 "

Machine Gun 30 cal 1000-1200 rounds/min
50 cal 500 650

Cannot fire more than 100 rounds
at a time must hit and at
least one minute before firing
again.

Tactics

Tactics - one shot, one fire, one
move - usually for 30 seconds

Positioned - one shot, one fire, one
move

In Case of Stoppage

1. Immediate action - just cocking
lever back
2. Repeat if you do not fire

Position Stoppage

1. 1st position stoppage - Belt handle
closed - see above, one operation
- 2nd position stoppage - Belt handle
1/2 way back - loose band off a coil
by hook handle, split case, to avoid

Figure 1000 - 1000 - 1000 - 1000
3rd section - 1000 - 1000
conveyance - 1000 - 1000
Conveyance - 1000 - 1000

Conveyance - 1000 - 1000
conveyance - 1000 - 1000

Groups of Machine -

1. Ball Group - important part
2. Ball group
3. Lock frame group
4. Lock frame
5. Lock frame
6. Ball plate group

37 main parts

1. Tube
2. Ball plate
3. Lock frame
4. Feed box
5. Tube Extension

FLARES

Bombing Flare M-26

1. 50" long, 8" dia., 51#
drops @ 11.6"/sec @ 900/100 CP for 35 min.
2. Has time delay fuse

✓ Landing Flare M-8A1

1. Time alt release is 2000'
2. drops @ 600"/min
3. 300,000 sp. for 3 min.
4. Max speed for dropping flare 200 mph.
5. No. 10 Landing Bomb after release
6. Useful life of flare is only 1 year & under in air flare.
7. Inspected every flight. & on 25 hr flare removed & released in case of delay
8. Aeriumum Compound Resonance
9. Silk chute

✓ Paratrooper Flare M-9

(~~flares~~)
1. 90,000 sp. for 1 min

2. Use A2 flare fuze in green
3. Never fired from ground

✓ Signal Flare - parachute supported (para)

1. M-10 300,000 CP. 30 sec white
2. fired in A2 flare green
3. M-15 white blinker 5 stars 1000 sp.
(5 sec light 4 sec dark)
4. M-16 same as M-15 only green

FREE falling Signal Flare

M-14	Red Star	Blinker	9 sec	4000 CP
AN-M28	2 star	R+R	7 sec	9000 CP
29	"	Y+Y	"	2000
30	"	G+G	"	6000
31	"	R+Y	"	9+2
32	"	R+G	"	9+6
33	"	G+Y	"	6+2
34	1 star	R	"	7000
35	"	Y	"	2000
36	"	G	"	6000

300,000 CP can be seen after 10 mi.

To tell color of signal flare letters are stamped on flare cap as well as the color painted on cap.

Misfunctions

1. Miss fire
2. Hang fire

Test

DUTIES OF SQUADRON OFFICERS

SUPPLY OFFICER - assist CO. in
issuing & preserving property and care
and feeding of mules.
Table of Base Allowance given
for each allowance.

Issue equipment to men on 32.

Make frequent inspections to keep
check on all supplies.

If indebted over horses equipment
must pay for it on Statement
of Charges.

Expendable property issued quarterly
up to allowance.

5% breakage allowed quarterly on
china.

Supply

Class I - Expendables

Class II - Blankets, etc.

III - Tools, Lubricants.

IV - Exceptional stuff, medical etc.

V - Ammunition.

Mass Mess Officer - make frequent
inspections for cleanliness and good
mess well balanced diet and variations.
Keep 469 up to date.

Rations - days meals

1. Field Ration -
2. Garrison Ration -
3. Travel Ration -

SEADRON ENGINEERING

- Revised 1. Engineering
2. Tech Supply
3. Communications

I Engineering

1. Maintenance and Inspection

A. Systems & records 150 ppm

1. Efficient checks

2. Forms 1A & 41B

lets all discrepancies in
ships.

3.

B. Responsible for and signs
for all plans, drawings,
tools, accessory equipment
office equipment etc.

- Must keep good records
on property.

C. System of inspections must
be checked on frequently and
and everything ready for
inspection by tech inspector

D. Responsible for personnel
when on duty.

II TECH SUPPLY

A. Responsible for obtaining all instrument
parts etc to keep planes in
operation.

B. Must be familiar with AC
supply.

III Commissioner's Office
4. Responsible and signs for
all equipment.

Q. 12

Alv. Fyler

~~2/10/19~~

Control position of bank at a
particular point back to place
1/10/19

1. Growing Crane, 19402, nose free
Can delay 1/10 on a mat

2. Growing Pigeon - 19405 Tail free

Delayed action, 1/10 on
part on Dumbarton body in case
19403 nose free about work

3/10/19 Pigeon - 19406 shipped

2. Stored in different building
than Boulders

3. Colter pins which are pulled
out before take up

4. Dumbarton wire pulled &
Boulders dropped

5. Left clip put in, end of
casing wire on Dumbarton
wire type free to prevent
wire from accidentally being
pulled out.

M line Boulders	107 Nose	105 Tail
Mask line	105 Nose	106 Tail
at Chert & Fringe	109 Nose	
Special Tail		

1/100 - 1004300

1/101 - 600

1/102 - 1000

Parachute Bomb - Bomb desc. by AC
attach target on ground from
the air.

Objectives

- 1. Line of communication.
- a. Roads
- b. R.R.
- 2. Communication elements.
- 3. Artillery concentrations.

Types of Targets or Objectives

- 1. Fixed
- 2. Transient
- 3. Fleeting

Light Bomb

Small high
burst size
covered with molten iron
with Chem. spray fog. last
in support of ground troops

Heavy Bomb

high speed
burst
high level capacity
long range

Bomb Offense - Bomb (Chemical)
Chemical
Incendiary

Density

3000 bomb rate 17' high 50' diam.
12' and (avg) 14' diam.

TASKS & TECHNIQUES OF AIR FORCES

EMPLOYMENT OF AVIATION

TECHNIQUE - Theory & Technical

Warfare - Planning & Testing

Learning, Use & Maintenance - Attached
and supporting other branches
for theory & artillery fire
control, etc. etc. etc.
Warfare & Light Forces

Low Level Recon. Intelligence
Mapping etc. etc. etc. etc.

OVERSEAS Operations - employment
of types of aviation.

Training Force - all types of
aviation, except etc. etc. etc.
in the line of operations.

Defence Force - and attack
theatre of operations, etc. etc.
zone of action - those of tactical
etc. etc. Use second line
equipment and air not
able to take care of any
large scale attack.

SUPPORT - Air Support Command
supporting ground force & attached
to them.

SP-42 Folios - Use second line
equipment in air combat
duke

Combat Operations

1. Always offensive
2. Effectiveness of combat aviation
does not depend on number
of aircraft but on effective
fire power.

TRANSPORT - Personnel and
mainly cargo

SP-42

1. High mobility if base on wheels
2. Thinner on 3 dimensions
3. High speed of movement
4. High fire power.

Deployment

1. Air operations proceed attack
of ground units and aircraft
of sea and attack.
2. Good communication must
be maintained.
3. Control of air must be
maintained as completely
as possible.
4. Commanders must know
limitations and possibilities of
aircraft units in this theater as well
as those of the enemy.

Ground Fire from Aircraft

Targets - Enemy - Main
Right - Green
Inside Hall - Lower
to Front - Fore

Rt - Green
Left - Red
Fore - Fore
Aft - Aft

{ Below
Above
Upper
Lower

Fire Control Officer

1. Shifts formation to get best fire control over existing targets -
2. Controls fire of all gunners in formation -
3. Assigns sectors of observation for gunners
4. Coordinates and coordinates fire.

SIZE OF FORMATION

1. Maneuverability desired
2. State of training of pilots
3. Defensive armament - turret gun
tail gun etc
4. Best formation is approx. 6 planes

4-20-B

Back Seat 1000'

3. flexible mounted gun.

Defense - undulating 100'-200' (highest)
skidding side to side
+ burrowing out
+ tight turns
horizontal attack violently

Formation - V or 3 in line
best always to use fighter
contact

B-24

Air Tactics References.

For Technique of Bomber Tactics

- Suppress 1. attack out of sun
2. Use haze, clouds, etc.
3. Coming in early morning
attacks from dark part of sky.
4. Attracting attention away
from main attack by use
of dummies

1000'

1. Search sky before takeoff and
landing.
2. Look around.
3. Never fly or climb st when
attacked.
4. Fighters should not try to
close in and attack even if they get

5. Never get in middle of Vg
except horizon.
6. Keep nose on enemy and
attack his blind spots.
7. Don't fire long bursts or long cone.
8. • Break away in a curving
turn - staggered.
9. Don't make a formation.
10. Formations.
 - a. Large formation less maneuverable. AA fire.
 - b. Know you are blind spots.
 - c. Work easily seen and
picked up from ground.
 - d. Make it impossible for
enemy to line up the
flank or aim at one
plane & hit another.
 - e. Flexibility & maneuverability.
 - f. Keep formation close away
from attacking fighter.
 - g. Use ground AA fire spread
formation so that one
burst will only get one plane.

Evasion

1. Always turn toward a fighter.
2. Don't reverse your turn when
pursued.
3. When flying away lo-
wer climb continually.
4. When AA fire is anticipated
do not fly near cloud tops
as that gives away elevation.
5. When entering clouds change

Direction -

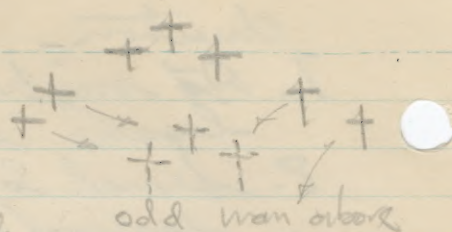
7. At night throttle down to lesser exhaust.
8. Search light on enemy, not engaged fighting in rear.
9. Defending against search light.
 - a. One plane fly low and loud to block out other planes.
 - b. Desynchronize engines.
 - c. Fly different formations at different heights.
 - d. Vary direction of flight.
 - e. Avoid sun, avoid light.
 - f. avoid alt. below 6,000 & 13,000 ft.
 - g. At night if you drop a plane it shuts out enemy.

GROUND STRATEGY

1. Approach from every side if possible.
2. Have protection planes above.
3. In attacking destroy enemy's air base & advantage of their hills blocking their vision.
4. Use high flying decoys to divert attention.
5. Air drops - best to drop in cooperation with tanks - first then ships, close support & tops cover.

JAPANESE STRAFING

3 plane V in center does work others as protection. When attack outside plane move in and form another V, one man for top cover.



JAPANESE

1. 4 engine patrol planes slow & easy targets
2. Overhead & high side approach aiming at engines which are easily fired.
3. Attacks at approx. 11,000 ft. in close formations, continue on str. runs until mission is accomplished or they are shot down
4. Zero fighter very manowable.

GERMANY

1. New gas - HN₂ dropped by light bombardment & pursuit.

Colorless gas - smells like fish in large quantities but barely recognizable in small quantities. Causes blisters blindness & death ~~on~~ inhalation, however action is delayed several days. Much more effective in every than mustard gas.

PERSUIT -

1. Great flexibility
2. Bomber escort
3. Interceptors
4. Obsolete general use other planes.

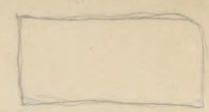
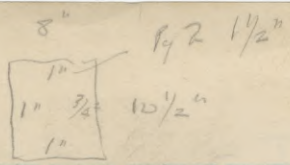
Process

1. Simple tactical plan.
2. Best plan for different type attack or defense.
3. Method of execution.
4. Speed & maneuverability.
5. Armament - position on plane^{etc}
6. Accuracy of fire - short range best.
7. Volume of fire.

Attack by Pursuit

1. attack, single rudder planes with no tail thrust directly from rear.
2. Twin rudder, no tail thrust, line up one rudder & top thrust.
3. For beam attacks come in from front quarter and blind spot caused by wing.
4. 3 planes attacking simultaneously considered best.
5. Don't fire closer than 250 yds.
6. Fire 3 sec bursts.

TEST



Correspondance

1. Single space + double between paragraphs.
2. Paragraphs Numbered 1.
in Body of letter a.
(1)

HEADING

(a)

Headquarters
Columbus Army Flying School
Office of the Commanding Officer

JAR/rbw

3 spaces

In reply refer to
333.1

Columbus, Miss.
August - 1942

Subject - Request for Transfer

To: - Commanding General 55 AATC, Maxwell Fld, Ala

For Commanding Officer

Indorsements

1. Stamped - Routine communications & k. (Rubber Stamps)
2. Written -

